DO YOU USE MACHINE BELTING?

SHULTZ BELTING CO.

THIS BOOK IS FILLED WITH INFORMATION
USEFUL TO ENGINEERS AND BELT USERS.

ON SKINNER LITH. ST. PAUL

INFORMATION

ON

SELECTION AND MANAGEMENT

OF

MACHINE BELTING,

WITH

Useful Tables for determining the Width of Belt and Horse-Power, etc.

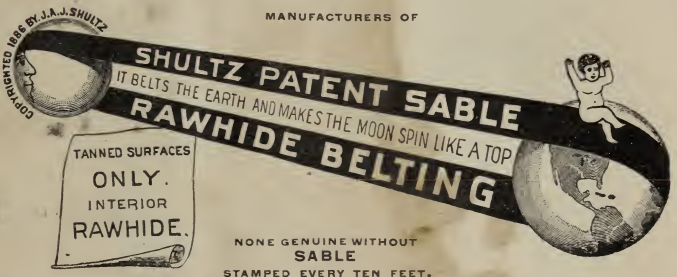
6th EDITION.

PUBLISHED, 1896, BY

SHULTZ BELTING CO.,

ST. LOUIS, Mo.,

MANUFACTURERS OF



NONE GENUINE WITHOUT
SABLE
STAMPED EVERY TEN FEET.

GEO. J. KELLEY, Manager,
154 SUMMER STREET, BOSTON, MASS.

SHULTZ BELTING CO. — ST. LOUIS.

WE take pleasure in presenting this little book to our patrons and the public. The first, second, third, fourth and fifth editions were so highly appreciated, that they were soon exhausted. We have doubled the issue of this edition; besides, it is enlarged, and contains more information. We invite a careful reading of its contents.

SHULTZ BELTING CO.

ST. LOUIS,
April, 1896.

IF BELTS ARE THE VEINS AND ARTERIES OF A FACTORY, WHY NOT GET THE BEST? FINE BUILDINGS AND THE BEST MACHINERY ARE USELESS WITHOUT THEM.

See page 46.

BELTING.

Among all the articles used in the various factories in all lines of trade, there is probably not one that creates more general interest or performs more important duties than that of *Belting.* No factory can be carried on without its use, and it is of the greatest importance in every case that the most perfect form of belting should be secured. It is only by using the best belting that the machinery of the factory can be utilized to its fullest capacity ; and if inferior belting is employed it immediately causes a considerable loss of power and time, and entails a series of evils that must necessarily result in a financial loss. Considerations of this importance have stimulated those in the business to produce a belting that should fulfil all the necessary requirements, and that should possess none of the disadvantages that have been found in the ordinary oak-tanned belting. This most desirable result has been definitely accomplished by **The Shultz Process.**

WHY

In preference to all others you should

USE

Shultz Patent Sable Rawhide Belting?

BECAUSE

It transmits from 25 to 33% more power;
It can be run slacker;
It is more durable;
It is more pliable;
It transmits power evenly and smoothly;
It runs true and straight;
It is lighter and stronger;
It is unaffected by atmospheric changes;
It has a minimum of stretch.

We are Willing to Send You a Belt on Trial.

Shultz Patent Sable Rawhide Belting,

UNLIKE OAK-TANNED LEATHER BELTING,

IS TANNED ONLY ON THE SURFACES,

THUS LEAVING

INTERIOR RAWHIDE,

WHICH IS THE FIBRE.

Our Belting is made of leather tanned on the surfaces only; the interior of the hide, which is the fiber, is RAWHIDE, and is softened and made pliable by our patent process. This gives it all the advantages of tanned leather, and it retains the strength of the RAWHIDE. The grain is soft and something like kid, which causes it to adhere to the pulley—this, combined with its great strength and pliability, gives it its wonderful driving power, and hence no lost motion. On account of its softness and pliability it is especially adapted in places where belts have to run over small pulleys at high speed, and where they have to run on a twist. It has no equal where there is hard service and great strain, and for main drive belts on engines it will outwear any other belting made.

All this belting is carefully put together, of selected stock, is stretched twice before it is made into belts, and is guaranteed short lap.

Our Belting has now been in use sixteen years all over the United States and Europe and has proved to be all we claim for it. There are some imitations of our Belting on the market, and to insure getting the genuine SHULTZ BELT, buy either from us or our authorized agents.

None Genuine without SABLE stamped every ten feet

BEWARE OF IMITATIONS.

To protect ourselves and the public from the NUMEROUS IMITATIONS, we are now staining our belting black, which is known as

SHULTZ PATENT SABLE RAWHIDE BELTING.

All goods will be stamped SABLE every ten feet. None genuine without.

PRICE LIST
OF
Shultz Patent Sable Rawhide Belting

SINGLE PLY.		SINGLE PLY.		SINGLE PLY.	
Ins. wide.	*Per Ft.*	*Ins. wide.*	*Per Ft.*	*Ins. wide.*	*Per Ft.*
1	$ 12	7	$1 08	25	$4 40
1¼	16	8	1 24	26	4 60
1½	20	9	1 40	27	4 80
1¾	24	10	1 56	28	5 00
2	28	11	1 72	30	5 50
2¼	32	12	1 88	32	6 00
2½	36	13	2 04	34	6 50
2¾	40	14	2 20	36	7 00
3	44	15	2 40	40	7 80
3¼	48	16	2 60	44	8 60
3½	52	17	2 80	48	9 40
3¾	56	18	3 00	50	9 80
4	60	19	3 20	52	10 20
4½	68	20	3 40	56	11 00
5	76	21	3 60	60	11 80
5½	84	22	3 80	64	12 60
6	92	23	4 00	68	13 40
6½	1 00	24	4 20	72	14 40

DOUBLE BELTS —DOUBLE ABOVE LIST.

PRICES AND DISCOUNTS SUBJECT TO CHANGE WITHOUT NOTIFICATION.

Our belting, both single and double, is short lap. Our belt, adhering as it does so tightly to the pulley, prevents our *single* belt from making a good shifting belt; hence, for shifting and cone belts we recommend our *double*, which is well adapted for either.

The belt that will transmit the most power, with the least strain on machinery is the *cheapest* and likewise the *best*.

Always run the grain side next the pulley, and the belt will last much longer.

Keep all machine oil off belting, and in greasing use no dressing unless known to be without injurious substances.

SEE REFERENCES ON PAGE 13.

SHULTZ PATENT

Sable Rawhide Dynamo Belting.

To the electrical industry, we especially recommend the Shultz Patent **Sable Rawhide Dynamo** Belting.

This special grade is made from selected parts of hides. Greater care is exercised in making the joints so that the belt shall be of uniform thickness, thereby avoiding, by smooth running, flickering lights and uneven power.

In ordering, specify if for Electric Lighting or for Railway Power.

None Genuine without SABLE stamped every ten feet.

REFERENCES.

Laboratory of Thos. A. Edison, Orange, N. J.
Edison Phonograph Works, Orange, N. J.
Edison General Electric Co., Schenectady, N. Y.
East River Electric Light Co., 425 E. 24th Street, N. Y.
N. J. & Penna. Concentrating Works, Ogden, N. J.
Thomson-Houston Electric Co., 44 Broad St., N. Y.
Harrisburg Electric Light Co., Harrisburg, Pa.
Excelsior Electric Co., 44 Broad Street, N. Y.
Westinghouse, Church, Kerr & Co , 17 Cortlandt St., N. Y.
Walker & Kepler, Philadelphia, Pa.
Grafton Electric Light Co., Grafton, N. D.
St. Louis Electric Power Co., St. Louis, Mo.
St. Louis and Suburban Railway Co., St. Louis, Mo.
Flushing and College Point Street Railway Co., Flushing, N. Y.
Passaic Print Works, Passaic, N. J.
Rahway Electric Light Co., Rahway, N. J.
Delhi Electric Light Co., Delhi, N Y.
New England Engineering Co., Waterbury, Conn.

See Testimonials.

BEWARE OF IMITATIONS.

To protect ourselves and the public from the NUMEROUS IMITATIONS, we are now staining our belting black, which is known as

SHULTZ PATENT SABLE RAWHIDE BELTING.

All goods will be stamped SABLE every ten feet. None genuine without.

PRICE LIST
OF
Shultz Patent Sable Rawhide Dynamo Belting.

Inches Wide.	Price Per Ft.	Inches Wide.	Price Per Ft.	Inches Wide.	Price Per Ft.
2	$ 56	7	$2 16	19	$ 6 40
2¼	64	8	2 48	20	6 80
2½	72	9	2 80	21	7 20
2¾	80	10	3 12	22	7 60
3	88	11	3 44	24	8 40
3½	1 04	12	3 76	26	9 20
4	1 20	13	4 08	28	10 00
4½	1 36	14	4 40	30	11 00
5	1 52	15	4 80	36	14 00
5½	1 68	16	5 20	40	15 60
6	1 84	18	6 00	48	18 80

Prices and discounts subject to change without notification.

ADHESION.

The Shultz Belting is close grained and is not porous like tanned leather, consequently there is a perfect vacuum between the belt and pulley, which causes great adhesion on account of the natural pressure of the air, and no jumping of the belt on the pulley.

No Pegs. No Rivets. Runs Perfectly Smooth. No Jarring, consequently No Flickering Lights. Try It.

In ordering, specify if for Electric Lighting or for Electric Railway Power.

Our Dynamo Belts are soft and pliable, and run around as small a pulley as a single oak-tanned, and slip less. The smallest pulley does not strain the belt.

Keep all machine oil off belting, and in greasing use no dressing unless known to be without injurious substances.

To Woodworking Industry.

It is agreed that for Planing, Matching, Tenoning, Saw Table, Cross Cut and Band Saws, Variety Moulders, Sand Papering and other woodworking machinery, a belt combining strength, pliability and durability is absolutely necessary, because of the high velocity of the small pulleys and consequent strain upon belt.

All these valuable points are found in the Shultz Patent *Sable Rawhide* Belting, which is described at length on pages 5, 6 and 7.

Send for trial belt and be convinced.

REFERENCES.

Geo. S. Hutchings, Boston, Mass.
H. H. Babcock Co., Watertown, N. Y.
Branning Mfg. Co., Edenton, N. C.
Carpenter & Dyett, Rome, N. Y.
Atwater, Armstrong & Clark, Rochester, N. Y.
Harvey & Sullivan, Austin, Pa.
W. E. Uptegrove & Bro., 457 E. 10th Street, N. Y
J. Hodge, Manchester, N. H.
Standard Furniture Co., Herkimer, N. Y.
National Casket Co., Rochester, N. Y.
W. H. Sawyer Lumber Co., Tonawanda, N. Y.
Calkins & Co., Tonawanda, N. Y.
Bliss & Suydam, Baldwinsville, N. Y.
C. T. Crouch & Son, Rochester, N. Y.
Copeland & Durgin Co., Rochester, N. Y.
Ocorr & Rugg Co., Rochester, N. Y.
Spicer & Hubbard, Plainfield, N. J.
F. Mohr & Co., 50 Elizabeth Street, N. Y.
Johnson Bros., 3 Broome Street, N. Y.

See Testimonials.

BELTING.

Many a Saw Mill, otherwise fairly well equipped, fails of doing good work simply through being badly belted. The belts may be too narrow or too light in thickness, or of uneven density, or of a material that, be they ever so wide or thick, will not retain sufficient tension, or they may be of the wrong material altogether for the particular place in which they are to run.

Very many mill men and not a few mill-wrights, have very inadequate ideas on this subject, and when belting up a mill are apt to fall back on the opinion and advice of the machinery or belting salesman. Instances are on record where mills have been belted purely experimentally ; that is, belts have been ordered with the hope that they would do the required work, but with the expectation that if they failed they could be replaced by others very cheaply.

The result in such cases generally is that the poor or weak belts in the lot will be run till they are used up instead of being thrown out at once on discovery of their insufficiency, and others of proper capacity substituted. But few have a full appreciation of the effect on the question of profit and loss, of poor belting, even when on but one machine in the mill.

The worst of it is, all the belts except one may be in perfect order, of good material and ample size, and the one poor and insufficient belt will counteract all efforts to do a good day's work. It may be only the slab-saw belt ; but if it fails to do its work, it might as well be the main driving belt, for with the slab-saw jammed in a thick, knotty cut, the slabs and edgings will pile up behind it and the sawyer will have to stop the carriage till the stuff is out of the way.

It is not the price paid the belt maker that shows the value of any belt, but the way that belt will do its work, and the length of time it will last. The only way to tell this is to keep a debit and credit account with it, not only charging it with the first cost, but with the lace leather required for a given time, the time required to keep it in running repair and the time of every man kept idle during the stoppage it occasioned, and the loss of saw bill. There are numerous cases where, if this were done, the saw mill owner would be astonished at the result and would find why he made no profits.

The belt is simply a medium for the transmission of power. A weak one is like a poor link in a chain. The power behind it may be all sufficient and the machine it should propel may be of the best pattern and workmanship, but with the weak link between the two, no good work can be accomplished.

One-half the belts in use in the saw mills of the United States, are either too narrow or too light. This occurs oftenest with the minor machines, which are often run with old, worn out belts, as well as with those too small. On the other hand it would be hard to find a belt in use anywhere actually too large. Occasionally one may be seen larger than absolutely needed, but they are generally used because on hand, having been bought for another place.

But it matters not where the poor belt is so long as it fails to do its work and keep the machine it propels up with the others; wherever it may be it always proves to be the dearest piece of machinery in the mill. If a belt will not do its work, do not stop to tinker with it if the fault is all in the belt. If it is old and worn out, so much the worse. It is cheaper to throw it away at once and get a new one at twice the cost.

But few belts need tighteners if they are wide enough and heavy enough to start with. At the best, tighteners are expensive luxuries in the mill. Aside from their first cost and cost of maintenance, they wear out the belts and use up a large amount or power, which is often a very important matter.

Care in selecting belts of even texture, well tanned, when of leather, of sufficient size and of the right material for the place they are to run in, will result in saving the saw mill owner much loss and vexation.—*Hardwood.*

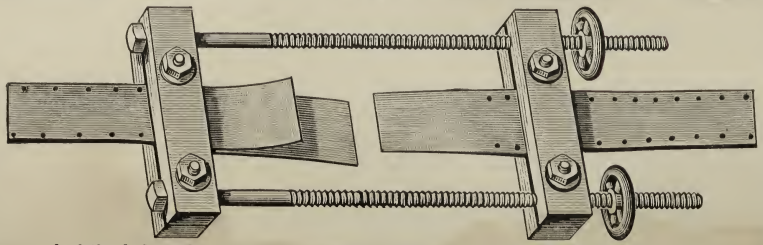
SHULTZ PATENT SABLE RAWHIDE BELTING.

REFERENCES.

Just a postal to any of them will decide you in our favor.

Amoskeag Mfg. Co., Manchester, N. H.
Austin, Drew & Co., Orange Valley, N. J.
American Express Co., 63 Broadway, N. Y. City.
Atlantic White Lead and Linseed Oil Works, Brooklyn, N. Y.
Botany Worsted Mills, Passaic, N. J.
Chelsea Jute Mills, Brooklyn, N. Y.
Edison Machine Works, Schenectady, N. Y.
Greene Knitting Co., Amsterdam, N. Y.
Harmony Mills, Cohoes N. Y.
Hecla Iron Works, Brooklyn, N. Y.
Hutchinson J. & Sons, 122d St. and 1st Ave., N. Y. City.
Inman Line Steamships, N. Y. City.
Kearney & Foote Co., Paterson, N. J.
Laboratory of T. A Edison, Orange, N. J.
Metropolitan Telephone and Telegraph Co., N. Y. City.
Massachusetts Cotton Mills, Lowell Mass.
Moore S. L. & Sons Co., Elizabethport, N. J.
North American Iron Works, Brooklyn, N. Y.
N. J. & Penna. Concentrating Works. 19 Dey St.. N. Y.
P. Pryibil, 518 W. 41st Street, N. Y. City.
Pratt Institute, Brooklyn, N. Y.
Paterson Ribbon Co., Paterson, N. J.
Red Star Line Steamships, Jersey City, N. J.
Savage & Holmes, Richmond, Va.
Sanford & Sons, Amsterdam, N. Y.
Saxony Knitting Co., Little Falls, N. Y.
Tide Water Oil Co., 12 Broadway, N. Y. City.
Taggart's Paper Co., Watertown, N. Y.
Travers Bros., W. 52d Street, N. Y. City.
Wright Peter & Sons, Jersey City, N. J.
Westinghouse, Church, Kerr & Co., 17 Cortlandt St., N. Y. City.
Windham Cotton Mfg. Co, Windham, Conn.

TO MAKE A BELT ENDLESS ON PULLEYS.



PLACE each end of the belt in the clamps, as shown in the above cut. Be careful to place the ends of the belt in the clamps with a square; screw down the nuts tight so the clamps cannot slip on the belt. In drawing the ends together draw both sides equally so as to make a straight joint. Draw the belt taut, and don't be afraid of breaking it, and when partly taut, turn the pulleys to get the belt on the pulley taut also; then draw the belt up taut again, taking out any stretch in it, and if the belt is too long cut off the ends of laps and prepare them the same as before cutting.

The best clamps for cementing are made of two pieces of 4 or 5-inch scantling, with a bolt through each end; cement the width of the clamps; slip the clamps over the part cemented, and draw them down by the bolts in the ends and let them remain a few minutes, then cement as much more, moving the clamps over the new cement and draw down as before, and so on till all is cemented. It is best to have the clamps crowned in the middle so as to make equal pressure across the joint.

Warm the glue or cement in any ordinary glue pot, and apply very hot with a brush. In using OUR belt cement no rivets are required.

PRICE LIST OF BELT CLAMPS COMPLETE.

8-inch	Belt	Clamps	and	Rods,	per	pair,	-	$ 9 00	20 inch	Belt	Clamps	and	Rods, per pair, - $14 75
10	"	"	"	"	"		-	10 00	24	"	"	"	" " - 16 00
12	"	"	"	"	"		-	11 50	26	"	"	"	" " - 17 25
14	"	"	"	"	"		-	12 50	30	"	"	"	" " - 19 00
16	"	"	"	"	"		-	13 25	36	"	"	"	" " - 22 00
18	"	"	"	"	"		-	14 00	44	"	"	"	" " - 25 25

ROUND BELTING.

PRICE LIST.

SOLID.

1/8 inch	$0 05	1/2 inch	$0 25
3/16 "	07	5/8 "	36
1/4 "	10	3/4 "	46
5/16 "	14	7/8 "	60
3/8 "	20	1 "	72
7/16 "	23		

TWIST.

1/4 inch	$0 14	1/2 inch	$0 30
5/16 "	18	5/8 "	36
3/8 "	22	3/4 "	46

RAWHIDE ROPE.

1/8 inch diam	$0 06	1/2 inch diam	$0 28
3/16 " "	07	5/8 " "	33
1/4 " "	11	3/4 " "	42
5/16 " "	17	7/8 " "	50
3/8 " "	22	1 " "	58

COUPLINGS.

We have also superior Hook and Eye Couplings of all sizes to suit Round Belts.

Prices can be obtained upon application.

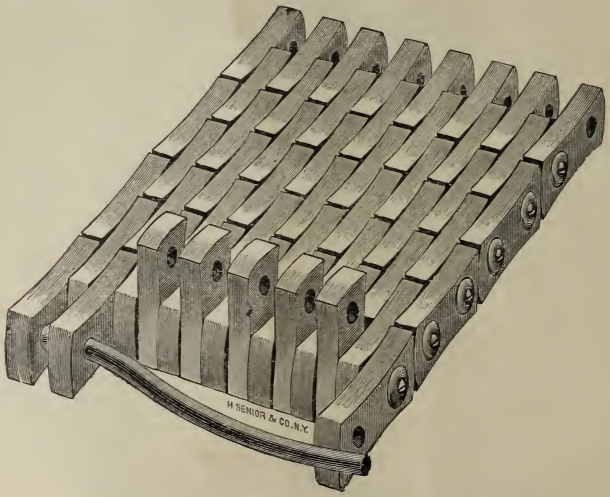
PRICES AND DISCOUNTS SUBJECT TO CHANGE WITHOUT NOTIFICATION.

SHULTZ PATENT

WOVEN LEATHER (LINK) BELT.

PATENTED 1890.

NO IRON ROD. No Hinge, because FLEXIBLE WITHOUT IT. ALL RAWHIDE LEATHER. Perfect Contact. Strong. Durable.



See other illustrations on pages 17 and 18.

We guarantee our Woven Leather Belts to have more driving power than any link belt yet placed upon the market.

Belts sold on trial, and any not coming up to guarantee can be returned to us.

Shultz Patent Woven Leather (Link) Belt.

PATENTED 1890.

Illustrations continued from pages 16 and 17.

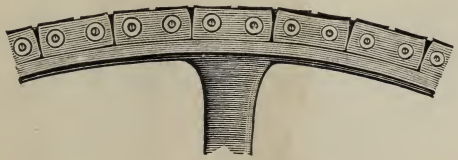


Figure 3.

Cut showing how the WOVEN BELT fits circle of pulley, covering it like a flat belt.

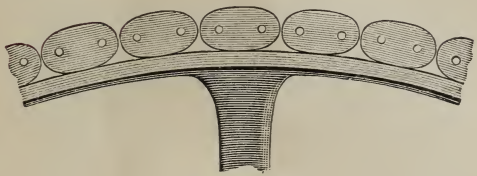


Figure 4.

Cut showing how the OLD STYLE fits the circle of pulley.

We guarantee our Woven Leather Belts to have more driving power than any link belt yet placed upon the market.

Belts sold on trial, and any not coming up to guarantee can be returned to us.

Shultz Patent Woven Leather (Link) Belt.

PATENTED 1890.

Illustrations continued from page 16.

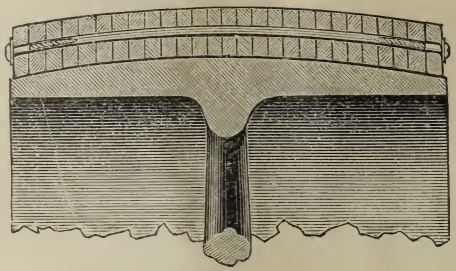


Figure 1.

Cut showing how the WOVEN BELT fits the crown of the pulley, touching every part.

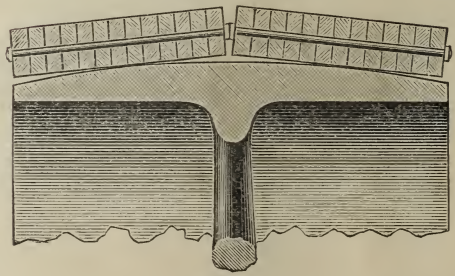


Figure 2.

Cut showing how the OLD STYLE IRON ROD AND HINGE CENTER belt DON'T fit a crowned pulley.

We guarantee our Woven Leather Belts to have more driving power than any link belt yet placed upon the market.

Belts sold on trial, and any not coming up to guarantee can be returned to us.

Shultz Patent Woven Leather (Link) Belt.

PATENTED 1890.

Heretofore Leather Link Belting has been made of short leather links, of a slightly oval form, which are secured at each end and laterally by means of iron rods or pins to the center of the belt, and connecting with a hinge or pliable joint in an effort to get pulley contact, but the result has been that on a crowned pulley only a small part of the belt touches the pulley (see Fig. 2, page 17,) as the iron rods render a complete pulley contact nearly impossible.

Unless a belt "hugs" a pulley with FLEXIBLE ADHESIVENESS, there is a great loss of driving power. Belts made of iron and leather are necessarily very heavy, because the weight of the iron rods must be added to the weight of the leather, which wears on the journals and of necessity lowers the transmitting efficiency, and CAUSES A HEAVY PULL ON THE COAL PILE.

In the Shultz Woven Leather Link Belt the links are made of leather, and of uniform size, and are held together NOT by metallic rods which are likely to fly out at any moment and become lodged in the working parts of machinery, but by leather or rawhide rods, which are remarkably tough, flexible and of light weight, and at the same time secure the links as safely as iron or steel rods. Thus constructed, it is flexible laterally, lengthwise and in all its parts, and is more pliable than a flat or any other belt in the market, so that the belt fits throughout its entire width with the utmost closeness to the face of the pulley (see Figs. 1 and 2 on page 17). This belt, being made entirely of leather, makes it much lighter than any other link belt. Can be run in any position where belts are used.

Both sides of the belt are alike and either side can be run next to the pulley; if one side becomes worn, it can be turned over.

See references on page 21.

NET PRICE LIST
OF
Shultz Patent Woven Leather (Link) Belt.
PER RUNNING FOOT.

WIDTH OF BELT.	11/16-in. thick.	7/8-in. thick	1-in. thick.
2 inch, per foot	$ 60	$ 70	$ 80
2½ " "	75	87	1 00
3 " "	90	1 05	1 20
3½ " "	1 05	1 22	1 40
4 " "	1 20	1 40	1 60
4½ " "	1 35	1 57	1 80
5 " "	1 50	1 75	2 00
5½ " "	1 65	1 92	2 20
6 " "	1 80	2 10	2 40
7 " "	2 10	2 45	2 80
8 " "	2 40	2 80	3 20
9 " "	2 70	3 15	3 60
10 " "	3 00	3 50	4 00
11 " "	3 30	3 85	4 40
12 " "	3 60	4 20	4 80
13 " "	3 90	4 55	5 20
14 " "	4 20	4 90	5 60
15 " "	4 50	5 25	6 00
16 " "	4 80	5 60	6 40
18 " "	5 40	6 30	7 20
20 " "	6 00	7 00	8 00
22 " "	6 60	7 70	8 80
24 " "	7 20	8 40	9 60
26 " "	7 80	9 10	10 40
28 " "	8 40	9 80	11 20
30 " "	9 00	10 50	12 00
32 " "	9 60	11 20	12 80
34 " "	10 20	11 90	13 60
36 " "	10 80	12 60	14 40
40 " "	12 00	14 00	16 00
44 " "	13 20	15 40	17 60
48 " "	14 40	16 80	19 20

Belts should be run with the slack side on top. For short belts or heavy work use belts 7/8-inch or 1-inch thick.

PRICES SUBJECT TO CHANGE WITHOUT NOTIFICATION.

SHULTZ PATENT WOVEN (LINK) LEATHER BELTING.

REFERENCES.

Lindell Street Railway, St. Louis, Mo.

St. Louis Electric Power Co., St. Louis, Mo.

Ladd Watch Case Factory, Providence, R. I.

The Electric Light Co., Albuquerque, N. Mex

The Central Distilling Co., St. Louis, Mo.

Cedarburg Woolen Mills, Cedarburg, Wis.

Liggett & Myers Tobacco Co., St Louis, Mo.

C. Piper Tobacco Co., St. Louis, Mo.

People's Street Railway Elec. Light and P. Co., St. Joseph, Mo.

Mount Vernon Electric Light Co., Mount Vernon, Ill.

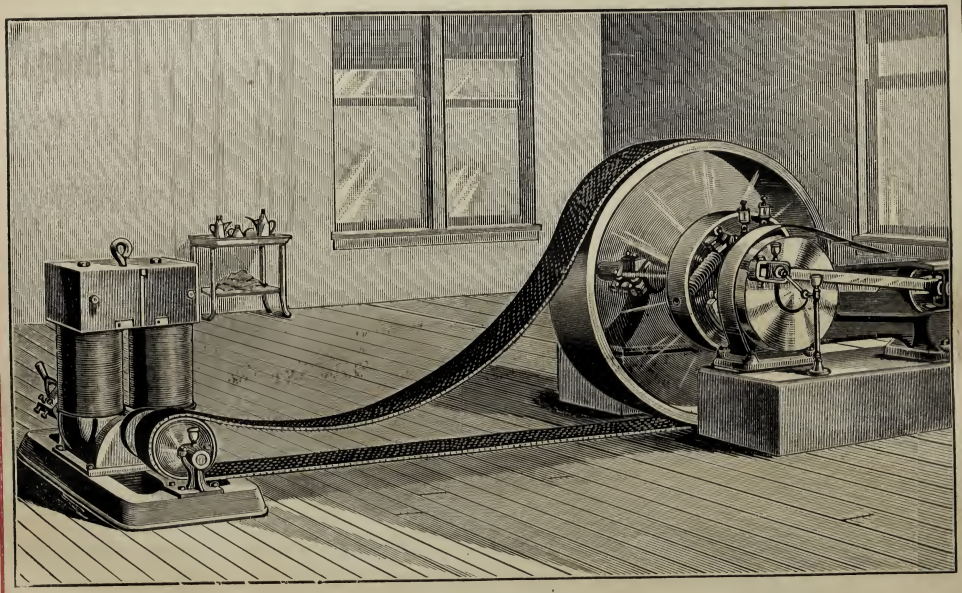
Livingston Electric Light Co., Livingston, Mont.

Eppler Welt Machine Co., Boston, Mass.

Pratt Institute, Ryerson St., Brooklyn, N. Y.

Maitland, Phelps & Co., 24 Exchange Place, N. Y.

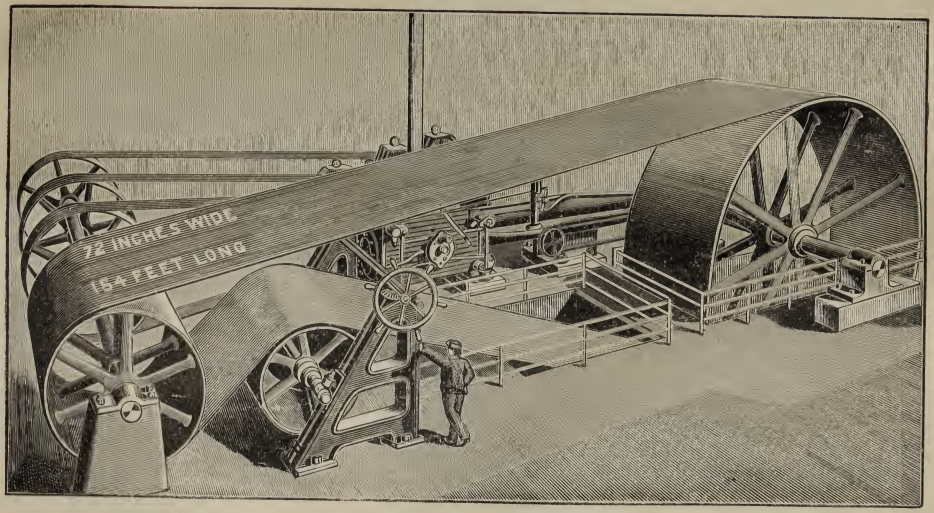
W. R. Grace & Co., Hanover Square, N. Y.



VIEW OF

SHULTZ PATENT WOVEN LEATHER (LINK) BELT.

Taken while running at the St. Louis Electric Power Company's Plant, 210 Lucas Avenue, St. Louis, Mo.
The above Cut shows how the belt should be run: slack side on top and not too taut.



POWER STATION OF ST. LOUIS & SUBURBAN R. R. CO.

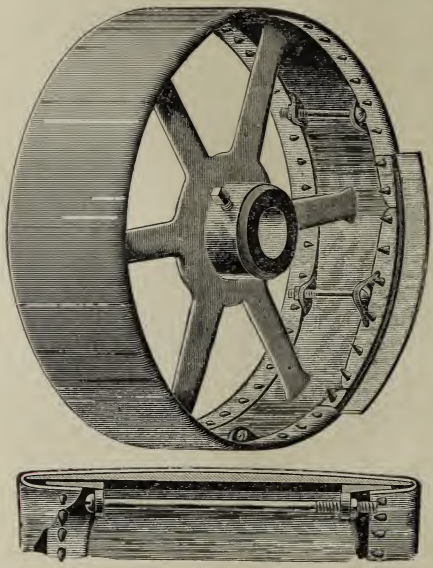
This Plant is belted with three 72-inch belts, each 154 feet long, two 34-inch and ten 16-inch generator belts, all of which are of our double Shultz Patent Sable Rawhide.

READ THE TESTIMONIAL ON PAGE 60.

SAVE Your Power, Your Belts, Your Money,

BY COVERING YOUR PULLEYS WITH

SHULTZ' PATENT LEATHER PULLEY COVERING.



Patented March 12th, 1888. Patented November 26th, 1889.

In ordering, *be sure to state* whether covering can be made *endless* at our factory or only laps prepared to be cemented when placed around the pulley. When pulley is on end of shaft, can make the cover endless, to be slipped on where used.

We do not guarantee against damage arising from oil or water.

We Solicit Correspondence. Prices Furnished upon Application.

SEE REFERENCES ON PAGE 26.

SHULTZ' PATENT LEATHER PULLEY COVERING.

Heretofore, in covering pulleys with leather, it has been customary to drill holes in the face at each edge of the pulley and rivet the leather on; but in covering a pulley in that way, it is impossible to keep the air from getting under and eventually breaking it out at the rivets. Besides, so many rivets being necessary to cover a pulley prevent the proper adhesion of belt to pulley and also cut out the belt, and to drill the holes the pulley had to be removed from the shaft, taken to a machine shop to be bored, and returned again to shaft after covering.

The **Shultz Patent Covering** being wider than the pulley face, its edges are brought over the edges of the rim and then turned towards each other and fastened on to malleable iron segment clamps, with teeth to hold leather; the clamps are placed around the pulley under the rim, and drawn together by a quarter-inch bolt, which draws the leather tight over the face and edges of the pulley. In this way, the leather can be drawn on the face of the pulley as tight as a drum head, as the process of drawing is in a degree similar, and should the covering ever become loose, it can be tightened in a few minutes, simply with a screw-driver to turn the bolts.

The pulley being so perfectly covered, both on face and edges, the belt will wear much longer; besides, a leather covered pulley will drive fifty per cent. more than an iron faced pulley (see Cooper on Belts and Pulleys); belts can also be run slacker, preventing heated journals and wear and tear on machinery, and covering will last a lifetime. We can furnish covering, clamps and bolts.

ADVANTAGES.

Easily applied. Anyone can apply it.
No Rivets to tear the belting.
No Cement to loosen and release cover from pulley.
Air excluded from between pulley and cover.
Durable. Will last a lifetime.
Slacker Belt running and, consequently,
Less wear and tear on machinery and on belting.
Oil consumption decreased
Power transmission increased.
Money saved.

SHULTZ PATENT LEATHER PULLEY COVERING.

REFERENCES.

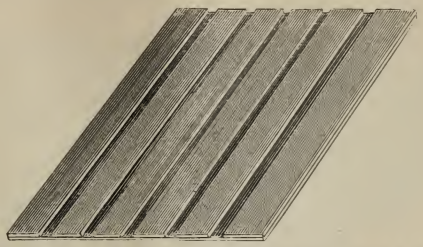
General Machinery Purposes.

American Press Association, Vesey St., N. Y. City.
Canton Saw Mill Co., Canton, Mo.
Curtis Bros. & Co., Clinton, Iowa.
Davidson Lumber Co., La Crosse, Wis.
Excelsior Springs Co , Excelsior Springs, Mo.
Gift J. W. & Co., Peoria, Ill.
Hall's Wm. Sons, foot of E. 106th St.. N. Y. City.
Hudnut Milling Co., Terre Haute, Ind.
Hamilton Club, Brooklyn, N. Y.
Ide A. L. & Son, Springfield, Ill.
Ketchum & McDougal, Brooklyn, N. Y.
Ladd E. P., Conway, Ark.
Mader Geo. & Son, Winchester, Ill.
Steamship Westernland.
Twenty-third St. Railway Co., foot of W. 23d St., N. Y. City.
Tiedman F., Jackson, Mo.
Wright Peter & Son, Jersey City, N. J.
Wabasha Roller Mill Co., Wabasha, Minn.

Electric Lighting Purposes, etc.

Brush Electric Light Co., St. Louis, Mo.
Bradford Electric Light Co., Bradford, Pa.
Columbus Electric Light and P. Co., Columbus, O.
Consolidated Light and P. Co., Eldorada, Kan.
Edison Electric Light Co., Kansas City, Mo.
East River Electric Light Co., N. Y City.
Edison Electric Il. Co., of Paterson, N. J.
Johnstown Electric Light and P. Co., Johnstown, Pa.
La Crosse Brush Elec. Lgt. Co., La Crosse, Wis.
Muscatine Gas, Elec. Light and Power Co., Muscatine, Iowa.
Springfield Elec. Light and P. Co., Springfield, Ill.
St. Louis Electric Power Co., St. Louis, Mo.
Tyler Electric Light and P. Co., Tyler, Tex.
Thompson-Houston Elec. Light Co., Yonkers, N. Y.
U. S. Electric Lighting Co., Newark, N. J.
Yonkers-Schuyler Electric Light Co., Yonkers, N. Y.

FIVE THOUSAND NOW IN USE.



GROOVED SABLE RAWHIDE BELTING.

(PATENTED.)

THIS Belt has GROOVES running lengthwise. These serve the purpose of channels to permit the escape of air from between Belt and pulleys, and to such a degree that the air cushion is overcome, which makes it possible to run it very nearly as slack as Link Belting, and infinitely more than the various hole-punched Beltings, which are deteriorated in strength in proportion to the size and number of the perforations. Besides this, the grooves are kept constantly clean by the current of air passing through them, and a decided advantage over perforations, which, as you doubtless know, soon clog with dirt and grease and consequently nullify their original intent.

It is also possible to run this Belt satisfactorily with either slack side on top or bottom, and it is practically noiseless.

From this brief description you will at once perceive its especial adaptability for rapid running machinery as well as superiority over other kinds of Belting, and you have but to make a single test in order to appreciate the advantages.

With the highest confidence in the PATENT GROOVED SABLE RAWHIDE Belting, we are willing to send a Belt on trial to responsible parties, and agree to pay freight both ways in event of dissatisfaction. Before doing so, however, we wish to be advised as to the work the Belt will have to perform, or whether for electric lighting, railway use or other machinery.

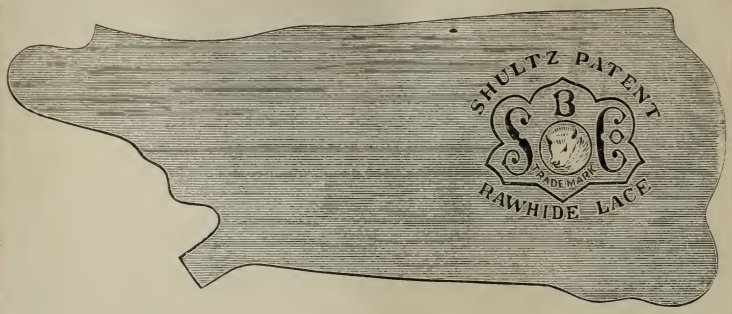
—OFFICE—
ST. LOUIS ELECTRIC LIGHT & POWER CO.,
OFFICE, 217 LUCAS AVENUE.

ST. LOUIS, MO., May 12, 1894.

SHULTZ BELTING CO., St. Louis, Mo.

GENTS:—We have been using three of the Ferguson Patent Grooved Belts made of your Patent Sable Rawhide Leather about two years. We have used all kinds of Belting and do not hesitate to say that these are the best Flat Belts we ever saw. They drive better, run very slack and perfectly noiseless and show no signs of wear. They only need to be known to be used.

Yours truly, ST. LOUIS ELECTRIC LIGHT & POWER CO.,
C. R. SCUDDER, Treasurer.



QUALITY of Rawhide Lacing, instead of price, receives usually, only secondary consideration; whereas, it should occupy first position in consumers' thoughts. First quality is indispensable to best results even with poor belting, saying nothing of the good.

Should like you to try our Rawhide Lacing, cut or in sides.

Sides are especially recommended.

Satisfaction guaranteed.

Reasonable prices.

Send a trial order.

SHULTZ PATENT RAWHIDE LACE LEATHER.

Our Lace Leather is made of *Rawhide*, by our patent process; no tanning used in its manufacture. It is *purely* rawhide, made soft and pliable, all the strength of the original hide being retained. It remains soft and pliable in all climates, and age does not affect it. Only the best slaughtered hides are used in our lacing. It is the best in the world. This is the genuine, old-fashioned FULLED RAWHIDE lace leather, and must not be confounded with so called Rawhide lace leather, which is in reality chemically tanned.

Price List.

Per square foot..... ..... cents

CUT LACINGS.

¼ inch, per 100 ft.....	$1 00	½ inch, per 100 ft.....	$2 00
5–16 " "	1 25	5/8 " "	2 75
⅜ " "	1 50	¾ " "	3 25

We are the Originators of the RAWHIDE LACING in the world.

FASTENING BELTS.

Many good methods of fastening the ends of belts are in use; but lacing is generally used. It is flexible, like the belt, and runs noiselessly over the pulley.

In punching a belt for lacing, use an oval punch, the longer diameter of the punch being parallel with the sides of the belt. Punch two rows of holes in each end, placed zig-zag. In a three-inch belt there should be four holes in each end—two in each row. In a six-inch belt, seven holes—four in the row nearest the end. A ten-inch belt should have nine holes; the edges of the holes should not come nearer than three-quarters of an inch to the sides, nor seven-eighths of an inch to the ends of the belt. The second row should be at least one and three-quarter inches a little from the end. On wide belts these distances should be even greater.

Begin to lace in the centre of the belt and take care to keep the ends exactly in line, and to lace both sides with equal tightness. The lacing should not be crossed on the side of the belt that runs next the pulley. In taking up belts observe the same rules as in putting on new ones.

Care should be taken that the ends of belts, if to be butted, are cut square across, else a crook may be made in the belt, and the belt maker be blamed for it. If to be made endless by a lap-joint, the edges of such joint should be on a right line with each edge of the belt. Large belts should be held in place with clamps while the ends are being fastened together. **Keep all oils and grease off our belts.**

SHULTZ BELT DRESSING.

Our belt dressing will fill a want long felt. It is made from pure articles (no gum or rosin used). It contracts the fibres of the leather, thus making it tighter on the pulleys, fills up the pores, and makes it adhere to the pulley, thus giving it more power. It also prevents *dampness* from affecting the belting, and adds life and pliability to it, which makes it wear much longer. Use no rosin or any other injurious article to make the belt adhere to the pulley, as none is needed when our Belt Dressing is used. Send for trial package. Satisfaction guaranteed.

Put up in 10, 25 and 50 lb. Tin Packages, and Barrels and Half Barrels. Price 35 cents per lb.

BELT CEMENT.

Having had so many calls for the same cement used on our own belting, which has proved so satisfactory, we are now putting up the same grade of goods in cans of one, two and five pounds each, sealed air tight, which will keep any length of time, and being made of the best materials, it is not only the best cement for belting but can be used for many other purposes where a good cement or glue is required.

Price, 75 cents per lb.

VALVES FOR BLAST FURNACES.

We call attention to the Valves we make of our Patent Leather for Blast Furnaces. We guarantee them to be the best ever made, and will outwear any other. We make every size and shape, and simply say try a sample lot, and if not as represented, need not be paid for. Read the testimonials from the largest concerns in the country on pages 60 and 66.

PICKER LEATHER.

We make the best quality of Picker Leather, on same principle we make belting, only made more pliable. We trim the bellies and heads off, using only the butts of the hides, which makes our Picker cost a little more per pound, but consumer does not have to pay for heads and bellies, which are of little use. Send for sample.

INFORMATION ON BELTING, Etc.

THE DRIVING POWER OF BELTS.

The average strain or tension, at which belting should be run, is claimed to be 55 pounds for every inch in width of a single belt, and the estimated grip is one-half pound for every square inch of contact with pulley, when touching one-half of the circumference of the pulley. For instance, a belt running around a 36-inch pulley would come in contact with one-half its circumference, or 56½ inches, and allowing a half pound per inch, would have a grip 28¼ pounds for each inch of width of belt.

We submit the following report from the testing department of Robt. Grimshaw's Engineering and Expert Offices, Philadelphia, Pa., testing the grip of our belt with oak-tanned belting. Our belting shows, with a tension of only 43¾ lbs. per inch in width, a grip of 78 lbs. on a 36-inch pulley, contact half the circumference, as against 28½ lbs., the average grip of oak-tanned; and, with a double belt, with a tension of 56½ lbs. per inch in width, or about the usual tension of a single belt, had a grip of 103 lbs., as against 28½ lbs:

"TESTING DEPARTMENT OF ROBT. GRIMSHAWS'
ENGINEERING AND EXPERT OFFICES,"
430 Walnut St., Philadelphia, Jan. 27, 1882.

SHULTZ BELTING COMPANY, St. Louis, Mo.

Dear Sirs: I have tested your fulled leather single belting for tensile strength against oak-tanned, with the following results:

Specimen A,	Single Oak-Tanned, 2¼ in. wide, broke at	-	1,820 lbs.
" B,	" " " " "	-	2,510 lbs.
" C,	" " " " "	-	2,700 lbs.
	Average,	-	2,343 lbs.
Specimen D,	Single Fulled Leather, 2¼ in. wide, broke at		2,625 lbs.
" E,	" " " " "		3,095 lbs.
	Average,	-	2,860 lbs.

The samples of fulled leather, were, therefore, for a given width, $\frac{2860}{2343}$ times as strong as the Oak Tanned. Specimen C, Oak-Tanned is the strongest we have yet had to test. In testing your Fulled Leather Belt against Oak-Tanned for grip, adhesion, or driving power, we used a new 24-inch turned cast iron pulley, with arc of contact of 180°, or half

the pulley circumference, and tested each belt under various tensions, testing the single belts with both flesh and grain sides next the pulley. All belts tested were new. The tests show that your four-inch Single Fulled Leather Belt, tested against a six-inch Single Oak-tanned Belt, with 32.5 lbs. tension per inch of width of the Fulled, and 31.66 Oak-Tanned, had a grip of 36 25 lbs. per inch of width, as against 20.5 lbs., comparing the flesh sides; and 36.25 lbs. as against 19.16 lbs. comparing grain sides ; or, as 1.77 to 1, in favor of the Fulled, comparing flesh sides; and 1.89 to 1, in favor of the Fulled, comparing grain sides. Increasing the tension to 45 lbs. per inch of width, which is the proper tension for Single Leather Belts, the flesh sides had grips of 58 lbs. per inch wide for the Fulled, and 44.5 lbs. for the Oak-Tanned ; and the grain sides 45.5 lbs. for the Fulled, and 27 lbs. for the Oak-Tanned; the grips with flesh sides being 1.303 to 1, in favor of the Fulled, and those of the grain side 1.69 to 1. in favor of the Fulled. Your riveted 4-inch Double Fulled Leather Belt, with 45 lbs. tension per inch wide, had a grip of 58 lbs. per inch of width, or $\frac{58}{45}$=1.27, as much as the single. Its greater strength, however, permits of greater tension; and with 62.5 lbs. tension per inch of width, there was obtained a grip of 71.75 lbs. per inch of width. It is not proper to put on lacings more than 66 lbs. per inch of width ; hence I give no figures showing the results with higher tension

On a new 36-inch turned cast-iron pulley, the new riveted lap, 4-inch Single Fulled Belt, with 43.75 lbs. tension per inch, had a grip of 78 lbs. per inch, and the Double, with 56.25 lbs. tension per inch had a grip of 103 lbs. per inch. The specimens tested show *great strength and pliability*; and under the conditions of our test, *great driving power.*

Very truly,

[Signed] ROBERT GRIMSHAW.
Director.

We are often asked to give the driving power of belting. For the benefit of our patrons we submit the following tables, which are as nearly correct as can be made and borne out by actual tests, and by Mr. Cooper's work on Belts and Pulleys. These tables and tests have been prepared for the driving power of tanned leather belting ; for the driving power of Shultz Belting, add thirty-three per cent.

HORSE-POWER TRANSMITTED BY LEATHER BELTS.

Driving Power of Single Belts.

Speed in Feet per Minute.	WIDTH OF BELT IN INCHES.								
	2	3	4	5	6	8	10	12	14
	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
400	1	1½	2	2½	3	4	5	6	7
600	1½	2¼	3	3¾	4½	6	7½	9	10½
800	2	3	4	5	6	8	10	12	14
1,000	2½	3¾	5	6¼	7½	10	12½	15	17½
1,200	3	4½	7	7½	9	12	15	18	21
1,500	3¾	5¾	7½	9½	11½	15	18¾	22½	26½
1,800	4½	6¾	9	11¼	13½	18	22½	27	31½
2,000	5	7½	10	12½	15	20	25	30	35
2,400	6	9	12	15	18	24	30	36	42
2,800	7	10½	14	17½	21	28	35	42	49
3,000	7½	11¼	15	18¾	22½	30	37½	45	52½
3,500	8¾	13	17½	22	26	35	44	52½	61
4,000	10	15	20	25	30	40	50	60	70
4,500	11¼	17	22½	28	34	45	57	69	78
5,000	12½	19	25	31	37½	50	62½	75	87

For Driving Power of Shultz Belting, add 33 per cent.

Driving Power of Double Belts.

Speed in Feet per Minute.	WIDTH OF BELTS IN INCHES.								
	6	8	10	12	14	16	18	20	24
	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
400	4¼	5¾	7¼	8½	10	11½	13	14½	17½
600	6½	8¾	11	13	15	17½	19½	22	26
800	8½	11½	14½	17½	20½	23	26	29	34½
1,000	11	14½	18¼	21½	25½	29	32½	36	43½
1,200	13	17½	22	26	30½	34½	39	44	52½
1,500	16¼	21¾	27¼	32½	38	43½	49	54½	65½
1,800	19½	26	32¾	39	45½	52	59	65½	78½
2,000	21¾	29	36½	43½	50½	58	65½	72½	87
2,400	26	34¾	44	52½	60½	69½	78½	88	105
2,800	30½	40½	51	61	71	81	91½	102	122
3,000	32½	43½	54½	65½	76	87½	98	108	131
3,500	38	50¾	63½	76	89	101	114	127	153
4,000	43½	58¼	72¾	87	101	116	131	145	174
4,500	49	65	82	98	114	131	147	163	196
5,000	54½	72¾	91	109	127	145	163	182	218

For Driving Power of Shultz Double Belting, add 33 per cent.

DOUBLE BELTS.

Economy on the part of consumers of belting may be exercised to their great advantage in many cases by the purchase of double belts in place of single. While this has especial reference to main drivers, it also holds good with regard to "counter-shaft," "cross," and all other belts having heavy work to do.

All belts over 12 inches wide should be double.

COMPARISON OF SINGLE AND DOUBLE BELTS.

(From a Treatise on Belting, by JOHN H. COOPER.)

"34-inch pulley on a line shaft running 200 r. p. m. drives a 45-inch pulley on a grindstone shaft. The grindstone is 72 inches diameter, its shaft nearly on same level as line shaft, and 7 ft. 4 inches away. About midway between the pulleys a ten-inch diameter tightener weighing 90 lbs., rests upon the top fold of belt, bearing it down 14 inches from straight line of pulley faces. This tightener is carried by a horizontal swinging frame, having radius arm 4 feet 6 inches long. A 7-inch *single* leather belt, of best make, was completely worn out in four months; another lasted seven months, while a 7-inch *double* Oak-tanned leather belt lasts about four years."—SAMUEL BEVAN, at H. Disston & Sons, Keystone Saw Works, Philadelphia.

SELECTION OF BELTS.

In ordering Belts, when pulleys are in place, give exact tape-line measure; or, if not in place, give diameter of each pulley and distance from centre to centre of shafts, and in all cases leave the necessary allowance to be made by us. If for *endless* belts, state whether the belt is to be made endless at our factory, or laps prepared ready for endless, to be put on by you. In ordering Belts, be careful to send for one as wide as the pulley will permit. Do not expect a *single* belt to do the work of a *double* belt. A double belt, or light double, will be found, in a great many cases, to be the cheapest in the end.

Never condemn a belt until the cause of failure has been well ascertained. In many cases it will be found, either that the ends have not been cut square; that it has been improperly laced, or that it is not proportioned to the work required of it. In such cases it is not fair to lay the blame on the belt. Do not be in too great a hurry to cut the slack out of a belt. First ascertain if it is doing all the work it should; for in the case of ours, one of their best points is that you can run them *slacker* than any other belt.

MECHANICAL PROBLEMS AND RULES.

PROBLEM 1.—To find the circumference of a circle, or a pulley:

SOLUTION.—Multiply the diameter by 3.1416, or as 7 is to 22 so is the diameter to the circumference.

PROBLEM 2.—To compute the diameter of a circle, or pulley:

SOLUTION.—Divide the circumference by 3.1416; or multiply the circumference by .3183; or as 22 is to 7 so is the circumference to the diameter, equally applicable to a train of pulleys, the given elements being the diameter and the circumference.

PROBLEM 3.—To find the number of revolutions of driven pulley, the revolutions of driver, and diameter of driver and driven being given:

SOLUTION.—Multiply the revolutions of driver by its diameter, and divide the product by the diameter of driven.

PROBLEM 4.—To compute the diameter of driven pulley for any desired number of revolutions, the size and velocity of driver being known:

SOLUTION.—Multiply the velocity of driver by its diameter, and divide the product by the number of revolutions it is desired the driven shall make.

PROBLEM 5.—To ascertain diameter of driving pulley:

SOLUTION.—Multiply the diameter of driven by the number of revolutions you desire it shall make, and divide the product by the number of revolutions of the driver.

6.—RULE FOR FINDING LENGTH OF BELT WANTED:—Add the diameters of the two pulleys together, divide the result by two, and multiply the quotient by three and one-seventh. Add the product to twice the distance between the centres of the shafts, and you have the length required.

For calculating the number of Horse-power which a Belt will transmit, its Velocity and the number of Square Inches in contact with the Pulley being known.

Divide the number of square inches of belt in contact with the pulley by two, multiply this quotient by velocity of the belt in feet per minute, and divide amount by 36,000; the quotient is the number of horse-power.

EXAMPLE.—A 20 inch belt is being moved with a velocity of 2,000 feet per minute, with six feet of its length in contact with the circumference of a four-foot drum; desired its horse power.

$21 \times 72 = 1,440 \div 2 \div 720 \times 2,000 = 1,440,000 \div 36,000 = 40$ horse power.

RULE FOR FINDING WIDTH OF BELT

WHEN SPEED OF BELT IN FEET PER MINUTE AND HORSE POWER WANTED ARE GIVEN.

FOR SINGLE BELTS.—Divide the speed of belt by 8. The horse power wanted divided by this quotient will give the width of belt required.

Example: Required the width of single belt to transmit 100 horse power. Engine pulley, 72″ in diameter. Speed of Engine, 220 revolutions per minute.

8) 4143 (speed of belt per minute.)
518) 100 $_{00}$ (horse power wanted.)
19″ width of belt required.

FOR DOUBLE BELTS.—Divide the speed of belt in feet per minute by 560. Divide the horse power wanted by this quotient for the width of belt required.

Example: Required the width of double belt to transmit 500 horse power. Engine pulley, 72″ in diameter. Speed of Engine, 220 revolutions per minute.

560) 4143 (speed of belt per minute.)
74) 500 $_{00}$ (horse power wanted.)
$67\frac{1}{2}$″ width of belt required.

EXTRACTS FROM ARTICLES ON BELTS.

By R. J. Abernathey.

Although there is not near as much known in general about the power of transmitting agencies as their should be, still it seems that almost any other method or means is better understood than belts.

One of the chief difficulties in the way of a better knowledge of the belting problem, is the relations that belts and pulleys bear to each other. The general supposition, and one that leads to many errors, is that the larger in diameter a pulley is the greater its holding capacity—the belt will not slip so easily, is the belief. But it is merely a belief, and has nothing to sustain it unless it be faith, and faith without work is an uncertain factor. I would like here to impress upon the mir ds of all interested, the following immutable principles or laws:

1. *The adhesion of the belt to the pulley is the same—the arc or number of degrees of contact, aggregate tension or weight being the same—without reference to width of belt or diameter of pulley.*

2. *A belt will slip just as readily on a pulley four feet in diameter, as it will on a pulley two feet in diameter, provided the conditions of the faces of the pulleys, the arc of contact, the tension, and the number of feet the belt travels per minute, are the same in both cases.*

3. *A belt of a given width, and making two thousand or any other given number of feet per minute, will transmit as much power running on pulleys two feet in diameter as it will on pulleys four feet in diameter, provided the arc of contact, tension and conditions of pulley faces all, be the same in both cases.*

It must be remembered, in reference to the first rule, that when speaking of tension, that aggregate tension is never meant unless so specified. A belt six inches wide, with the same tension, or as taut as a belt one inch wide, would have six times the aggregate tension of the one inch belt. Or it would take six times the force to slip the six inch belt as it would the one inch. I prefer to make the readers of this, practical students. I want them to learn for themselves. Information obtained in that way is far more valuable, and liable to last much longer.

In order that the reader may more fully understand whether or not a large pulley will hold better than a small one, let him provide a short, stout shaft, say three or four feet long and two inches in diameter. To this shaft firmly fasten a pulley, say twelve inches in diameter, or any other size small pulley that may be convenient. The shaft must be then raised a few feet from the floor and firmly fastened, either in vices or by some other means, so that it will not turn. It would be better, of course, to have a smooth-faced iron pulley, as such are most generally used. So far as the experiment is concerned, it would make no difference what kind of a pulley was used, provided all the pulleys experimented with be of the same kind, and have the same kind of face finish. When the shaft and pulleys are fixed in place, procure a new leather belt and throw it over the pulley. To one end of the belt attach a weight, equal say to forty pounds—or heavier if desired—for each inch in width of belt used ; let the weight rest on the floor. To the other end of the belt attach another weight, and keep adding to it until the belt slips and raises the first weight from the floor. After the experimenter is satisfied with playing with the twelve-inch pulley, he can take it off the shaft and put on a twenty-four-inch, a thirty-six-inch, or any other size he may wish ; or what is better, he can have all on the shaft at the same time. The belt can then be thrown over the large pulley and the experiment repeated. It will then be found, if pulley faces are alike, that the weight which slipped the belt on the small pulley will also slip it on the large one. The method shows the adhesion of a belt with 180 degrees contact, but as the contact varies greatly in practice, it is well enough to understand what may be accomplished with other arcs of contact. But, after all, many are probably at a loss how to account for some observations previously made. They have noticed that when a belt at actual work slipped, an increase in the size (diameter) of the pulleys always remedied the difficulty and prevented the slipping.

A belt has been known to refuse to do the work allotted to it, and continue to slip over pulleys two feet in diameter, but from the moment the pulleys were changed to three feet in diameter there was no further trouble. These observed facts seem to be at variance with and to con-

tradict the results of the experiments that have been made. All, however, may rest assured that it is only apparent, not real.

The resistance to slippage is simply a unit of useful effect, or that which can be converted into useful effect. The magnitude of the unit is in proportion to the tension of the belt. The sum total of useful effect depends upon the number of times the unit is multiplied. A belt six inches wide and having a tension equal to forty pounds per inch in width, and traveling at the rate of one foot per minute, will raise a weight of 240 pounds one foot high per minute. If the speed of the belt be increased to 136.5 feet per minute, it will raise a weight of 33,000 pounds per minute, or be transmitting one horse power. The unit of power transmitted by a belt is rather more than its tension, but to take it at its measured tension is at all times safe, and forty to forty-five pounds of a continuous working strain is as much, perhaps, as a single belt should be subjected to. A little reflection will now convince the reader that a belt transmits power in proportion to its lineal speed, without reference to the diameter of the pulleys. Having arrived at that conclusion, it is then easy to understand why it is that a belt working over 36-inch pulley will do its work easy, when it refused to do it and slipped on 24-inch pulleys. If the belt traveled 800 feet per minute on the 24-inch pulleys, on the 36-inch it would travel 1,200 feet, thus giving it one-half more transmitting power. If, in the first instance. it was able to transmit but eight horse power ; in the second instance it will transmit 12-horse power. All of which is due to the increase in the speed of the belt and not to the increase in the size of the pulleys ; because, as has been shown, the co-efficient of friction, or resistance to slippage, is the same on all pulleys with the same arc of belt contact.

There is no occasion for elaborate and perplexing formulas and intricate rules. They serve no useful purpose, but tend only to mystify and puzzle the brain of all who are not familiar with the higher branches of mathematics—and it is the fewest number of our every-day practical mechanics who are so familiar. In all, or nearly all treatises on belting the writer will tell you that at 600, 800 or 1,000 feet per minute, as the case may be, a belt, one inch wide, will transmit one-horse power ; and yet when we come to apply their rules in practice, no such results can be obtained one time in ten. The rules are just as liable to make the

belt travel 400, 1,000 or 1,600 per minute per horse-power, as the number of feet they may give as indicating a horse-power.

I have adopted, and all my calculations are based upon the assumption that a belt traveling 800 feet per minute, and running over pulleys both of which are the same diameters, will easily transmit one-horse power for each inch in width of belt. A belt under such circumstances would have 180 degrees of contact on both pulleys without the interposition of idlers or tighteners.

The last proposition being accepted as true, and the basis correct, the whole matter resolves itself into a very simple problem, so far as a belt with 180 degrees contact is concerned. It is simply this: If a belt traveling 800 feet per minute transmit one-horse power, at 1,600 feet, it will transmit two-horse power, or if 2,400 feet, three-horse power, and so on. It is no trouble for any one to understand that, if he understands simple multiplication or division.

It is not, however, always the case that both pulleys are the same size, and as soon as the relative sizes of the pulleys change, the transmitting power of the belt changes; and that is the reason why no general rule has ever or ever will be made for ascertaining the transmitting capacity of belts under all circumstances. When the pulleys differ in size, the larger of the two is lost sight of—it no longer figures in the calculations—the small pulley only must be considered. To get at it, the number of degrees of belt contact on the small pulley must be ascertained as nearly as possible, and use for a guide, for getting at the transmitting power, the next established basis below. Of course, the experimenter can make a rule for every degree of variation, but it would require a great many, and is not necessary. I use five divisions, as follows:

For 180 degrees useful effect.....	100
" 157½ " " "	.92
" 135 " " "	.84
" 112½ " " "	.76
" 90 " " "	.64

The experimenters may find that my figures are under obtained results, which is exactly what they are intended to be, more especially at the 90 degree basis. I wish to make ample allowance.

To ascertain the power a belt will transmit under the first named conditions: Divide the speed of the belt in feet per minute by 800, multiply by its width in inches and by 100. For the second, divide by 800, multiply by width in inches and by .92. Third place, divide by 800, multiply by width in inches and by .84. Fourth place, divide by 800, multiply by width in inches and by .76. Fifth place, divide by 800, multiply by width in inches and by .64. As an example: What would be the transmitting power of a 16-inch belt traveling 2,500 feet per minute by each of the above rules?

1st: $2{,}500 \div 800 = 3.125 \times 16$ and $100 = 50$ h.p.
2d: $2{,}500 \div 800 = 3.125 \times 16$ and $.92 = 46$ h.p.
3d: $2{,}500 \div 800 = 3.125 \times 16$ and $.84 = 42$ h.p.
4th: $2{,}500 \div 800 = 3.125 \times 16$ and $.76 = 38$ h.p.
5th: $2{,}500 \div 800 = 3.125 \times 16$ and $.64 = 32$ h.p.

As I have said, if the degrees of contact come between the divisions named above, in order to be on the safe side, calculate from the first rule below it, or make an approximate, as they like.

If the above lesson is studied well, and strictly used, there can be no excuse for any mechanic putting in a belt too small for the work it has to do, provided he knows how much there is to do, which he ought, somewhere near at least.

BELTS—THE INFLUENCE OF SPEED—DIMENSIONS OF PULLEYS.

By Charles A. Hague.

We see by far too many pulleys disproportionately small, or running too slow for the work they are expected to do. A belt, to work to advantage, must have a high velocity; and to attain this, either pulleys of large diameter must be employed, or the shaft must have a high rate of revolution. Horse power is a certain number of foot pounds developed per minute; and as foot pounds are simply pounds of pressure or strain multiplied by velocity in feet traveled, it follows that the greater the speed the less will be the required strain to produce any certain

horse-power. This minimum of power brings benefits with it, as reduction to lowest terms of pressure on shafting, and consequent reduction of friction, both from direct pressure and from springing due to heavier pressure. A light pressure upon a journal also prevents the oil being forced out from between journals and bearings. The large pulleys necessary to high belt speed present a greater value of surface for holding the belt to its work.

There are an almost endless number of conditions resulting from the pulley question. We have repeatedly witnessed the breaking of shafts from excessive cross-strain, caused by over-tight belts, and have seen the breaking prevented, oil saved, power economized, and repairs rendered unnecessary by simply increasing the diameter of the pulleys. The shafting not only suffers, but the belting and fastening come in for a large share of the general affliction. Where small pulleys are used, and the belt is exceedingly taut, it is often necessary to secure the ends of the belt by an over-lapping patch, laced or riveted; whereas, by employing proper-sized pulleys the belt may be held by the ordinary method of lacing. The principle of foot pounds is the correct one to apply to belt speed and pulley sizes, but it may be more convenient to some to look at the question in the light of leverage. With a shaft running at 200 revolutions per minute, it will certainly be easier to turn it by means of a four-foot lever (pulley radius) than by one only two feet long; but the pulley circumference, multiplied by 200, gives the feet of travel per minute, and this result, multiplied by the pressure required at the pulley rim to keep the shaft up to speed will exhibit the foot pounds expended per minute to run the shaft.

This matter of reducing the action of a belt and pulley to its foundation principles, of a certain number of pounds of pressure operating at a certain rate of motion, or, in other words, the science of transmitting power by belting, is not grasped comprehensively anything like as generally as it should be. Men are quite often met with who fancy that a steam engine should have a balance wheel considerably larger than the pulley upon the crank shaft by which the engine is belted to the machinery; and that belting from the rim of the balance wheel itself is most pernicious, because in some unexplained manner the engine is choked down, or held back. As an example, I call to mind a case in

which it required a pretty sharp controversy to induce the presiding genius to relinquish the idea of placing a pulley considerably smaller than the balance wheel upon the crank shaft of the engine, belting from this pulley to a counter-shaft, and from the counter-shaft to the machine to be driven; the only reason for such an arrangement being that it would give the balance wheel a certain amount of "leverage" over the the belt pulley. The idea seemed to be lost sight of, or perhaps was never entertained, that the power transmitted was simply so many foot pounds, obtained by multiplying the resistance of the belt by the speed at which it traveled, and that the slower the speed of the belt the greater the pressure must be to obtain the same product.

The science of transmitting power from a steam engine by means of a belt, is embodied in the following: In the first place, an engine which is in good proportion to its load, will develop and transmit a certain power, independently of the manner in which it is connected to its load. The manner of connection determined, mainly, how much power shall be used in friction of engine and belt, and how much net power shall go to the machinery to be driven. The diameter of a belt pulley upon the engine shaft is independent of every and all considerations, except obtaining a high belt speed, and all conditions of transmission can be so reduced that the belt speed and balance wheel requirements coincide.

If the engine is of insufficient power, or its balance wheel is not heavy enough, or its rate of revolution is too slow, or the regulating apparatus is incompetent, the delivery of energy through the belt will be unsteady, no matter how the connection is made. The whole compass of the object in view is to get the most power, in proportion to the engine, in the steadiest manner, just where it is wanted; and the method, which is the most direct under the conditions, conforms most closely with science and sense.

The idea of "leverage" is, no doubt, the prominent one with such as advocate the large balance wheel and small pulley plan, and to those people it may be remarked that the question of leverage does not enter into the principles of dynamic energy; and if they would recognize this fact, and lay aside completely the leverage idea, to begin with, and then absorb the idea that dynamic energy, or power, is simply two factors multiplied together, they would stand some chance of looking at this

important matter in a clearer light. The factors to be multiplied together are force and motion. In transmitting power by a belt, the force is the resistance to slipping of the belt upon the pulley, and the motion is the speed of the belt. It must be obvious that in considering these two factors, they are independent of everything else. If the machinery does not run properly, and it is the fault of the belting, then one or the other of these two factors is wrong ; and they are so curiously blended that if one is wrong the other is wrong. That is, if the resistance to slipping of the belt upon the pulley is insufficient to either drive the load upon the second pulley, or prevent the driving pulley from slipping around within the belt, a change of belt speed by enlarging the second pulley and increasing the speed of the engine, will increase the value of both the factors by reducing the resistance necessary upon the pulley and by increasing the rate of motion. To demonstrate this matter in figures, we will suppose that a certain belt will incline to slip a little in endeavoring to transmit 7½ horse power. The belt is running at a speed of 3,300 feet per minute, and the resistance upon the pulleys is 75 pounds. The two factors here to be multiplied are 3,300 feet travel and 75 pounds resistance, giving 247,500 foot pounds, or 7½ horse power. We find that the belt is not quite equal to the task, so, by enlarging the second or driven pulley, and increasing the engine speed to bring the driven shaft up to the speed it was at first running, we increase the belt speed to 4,400 feet per minute, and to drive 7½ horse power at this speed it will only require 56¼ pounds resistence upon the pulleys, thus securing a margin of safety of between 15 and 20 pounds in resistence. We now find that the belt running at 4,400 feet per minute, and requiring a resistance of but 56¼ pounds will easily drive a load which it failed to drive when running 3,300 feet per minute, and with a resistance of 75 pounds.

BELTING.

A Letter from the Journal of Railway Appliances.

Cog wheels or gear wheels are being rapidly superceded by bands or straps, which in this country are known simply as belting, and which latter have for most cases the very decided advantages over toothed

gearing that they enable power to be transmitted and sub-divided with greater convenience and less expense, and are more easily and more cheaply repaired in time of accident, and by being less noisy than toothed gears are applicable in many lines of business where the excessive and even at times deafening noise of the latter would render their use impracticable at any price.

In this connection a noted French authority says:

"In regard to the relative friction with belts or cords, and with toothed gearing, it is that theoretically the advantage is always more or less on the side of belts or cords, while a practical confirmation of this conclusion is furnished by the instance of a spinning mill, in which toothed gearing driving 18,000 spindles was replaced by belts, with a saving of 20 per cent. in friction, or 3½ per cent on the effective driving power transmitted; and in no case do belts practically cause more friction than toothed gearing."

It is strange that while there are very few lines of business which could be carried on at all without the use of belting, there are very few things which are so imperfectly understood and in which those most interested from a pecuniary point of view take less interest.

A manufacturer puts in months of time and worry and spends thousands of hard-earned dollars in order to put up a model factory in which he can make the maximum amount of money per year. He gets an architect to plan and a master builder to erect the new building. He puts up a building that he is proud of, and sometimes one that the whole town is proud of, and he has it photographed and engraved, and the pictures sent all over the country. He invites tenders from the most celebrated builders of economical, well-governing and durable engines, and stipulates that they shall beat their best previous records. He will see that the boilers get the biggest possible money's worth. He will provide for the reception and distribution of the raw material, its economical division and conversion, and cheap and speedy shipment to the four quarters of the known world, with provision for reaching any places that may be opened up to trade, later on. He will get all the best labor-saving machines and hire the best attainable labor to run them. He will put in elevators and gas and speaking tubes and fire escapes, and electric lights, and ventilators, and steam pumps and telephones,

and all the other modern improvements. But when the time comes to belt his machines, the money and the knowledge and the enterprise all seem to have suddenly given out. He then commences to "save at the spigot," and later on he may, or may not, discover that he is "wasting at the bung-hole."

He gets pulleys that are from 10 to 20 per cent. too narrow in the face, and on these he runs single belts where the service really calls for double, or light double at the very least, and goes into the chaffering business to get the very bottom discount, frequently buying the made-up belting at a less cost than the hides are quoted that would be necessary to make a prime and durable belt. The thicker the discount the thinner the belt. The longer the terms of payment, probably the shorter the belt will last.

It is tolerably well understood that the better the article the average workman is given, the better the care which he will take of it. The expensive automatic cut-off engine is kept clean, bright, and in good order; flowers and bright oil cans adorn the well-lighted engine-room; but the main belt flaps as though a professional carpet-shaker were trying his hand at it; and as for the smaller belts on which the steady running of the machinery depends, the ends are not square, the joints are crooked and the belts waving from side to side, sometimes clear off the pulleys, and slipping as if that was the principal result aimed at and paid for. The edges are curled up, the scarfing has got discouraged and opened out, the lacing is slapping the beams of the ceiling, the lace holes are tearing out, and the whole belt is either soaking with machine-oil or dry as a lime-burner's wig. The probability is that the flesh side is put next the pulley, unless for variety, part of the belt length is flesh side to the pulley and the other part grain side to. The long belts are flapping and the shorter ones fairly creaking with excessive tension put on with a binder.

Sometime or other, the proprietor wakes up to the costly fact that the belts are not up to standard, and he decides to change. But he is generally very careful to get an additional 2½ per cent. discount when he makes the change. The consequence is that "the last state of this man is worse than the first."

There are establishments in which a record is kept of the performance of each belt in the place; but the list of them could be written in large letters on a small piece of paper,

Manufacturers will find that it will pay them to exercise liberality and judgment in the purchase of driving belts, skill and experience in their laying out and putting on, and watchfulness and care after they are running. Attention to this matter will make a great difference on the desirable side of the profit and loss account.

J. A. J. SHULTZ.

St. Louis, Mo.

PRACTICAL NOTES ON BELTING.

The formula given below is based on the experience of engineers in Great Britain, America and France. It serves the purpose of showing what width of belt will do the required work most efficiently and at the same time last the maximum number of years. Many engineers, more especially in this country, are content to provide belts of greatly reduced width and of single substance, instead of double, hence the frequent complaints of their stretching, breaking and lasting so short a time. As a matter of convenience and arrangement of machinery, a narrower belt than that which is shown by the generally accepted formula is often imperative; but in the absence of any such condition it is questionable economy to part materially from it. The following may be regarded as an axiom. To use a belt of ample width and substance for the work required, is to secure for it a long existence, with satisfaction to all concerned.

Directions for calculating the width of belts required for transmitting different numbers of horse-power: Multiply. 33,000 by the numbers of horse power to be transmitted, divide the amount by the number of feet the belt is to run per minute; divide the quotient by the number of feet or parts of a foot in length of belt contact with smaller drum or pulley; divide the last quotient by six, and the result is the required width of a tanned leather belt in inches.

Explanations.—The figure, 33,000, represents the number of pounds a horse is reckoned to be able to raise one foot high in a minute. To obtain the number of feet a belt runs in a minute, find the number of

revolutions per minute of the driving shaft and multiply by the circumference of the drum, which is always 3.1416 its diameter. The final division by six is because half a pound raised one foot high per minute, is allowed to each square inch of belting in contact with the pulley; a pound must, therefore, be allowed to two square inches, or six pounds to a strip one foot long and one inch wide.

Example.—Required the width of a single belt, the velocity of which is to be 1,500 feet per minute; it has to transmit 10 horse power, the diameter of the smaller drum being four feet with five feet of its circumference in contact with the belt.

$33{,}000 \times 10 = 330{,}000 \div 1{,}500 = 220 \div 5 = 44 \div 6 = 7\frac{1}{2}$ inches, the required width of belt.

Directions for calculating the number of horse power which a belt will transmit. Divide the number of square inches of belt in contact with the pulley by two; multiply this quotient by the velocity of the belt in feet per minute; again we divide the total by 33,000 and the quotient is the number of horse power.

Explanations.—The early division by two is to obtain the number of pounds raised one foot high per minute, half a pound being allowed to each square inch of belting in contact with the pulley.

Example.—A six-inch single belt is being moved with a velocity of 1,200 feet per minute, with four feet of its length in contact with a three-foot drum. Required the horse power:

$6 \times 48 = 288 \div 2 = 144 \times 1{,}200 = 172{,}800 \div 33{,}000 =$ say $5\frac{1}{4}$ horse-power:

It is safe to reckon that a double belt will do half as much work again as a single one.

HINTS TO USERS OF BELTS.—1. Horizontal, inclined and long belts give a much better effect than vertical and short belts.

2. Short belts require to be tighter than long ones. A long belt working horizontally increases the grip by its own weight.

3. If there is too great a distance between the pulleys, the weight of the belt will produce a heavy sag, drawing so hard on the shaft as to cause great friction at the bearings: while at the same time the belt will have an unsteady motion, injurious to itself and to the machinery.

4. Care should be taken to let the belts run free and easy so as to prevent the tearing out of the lace holes at the lap; it also prevents the rapid wear of the metal bearings.

5. It is asserted that the grain side of a belt put next to the pulley will drive 30 per cent. more than the flesh side.

6. To obtain a greater amount of power from belts the pulleys may be covered with leather; this will allow the belts to run very slack and give 25 per cent. more durability.

7. Leather belts should be well protected against water and even loose steam and other moisture.

8. In putting on a belt, be sure that the joints run with the pulleys and not against them out.

9. In punching a belt for lacing, it is desirable to use an oval punch, the larger diameter of the punch being parallel with the belt, so as to cut out as little of the effective section of the leather as possible.

10. Begin to lace in the centre of the belt, and take care to keep the ends exactly in line, and to lace both sides with equal tightness The lacing should not be crossed on the side of the belt that runs next the pulley. Thin but strong laces only should be used.

11. It is desirable to locate the shafting and machinery so that belts shall run off from each other in opposite directions, as this arrangement will relieve the bearings from the friction that would result where the belts all pull one way on the shaft.

12. If possible, the machinery should be so planned that the direction of the belt motion shall be from the top of the driving to the top of the driven pulley.

13. Never overload a belt.

14. A careful attention will make a belt last many years, which through neglect might not last one.—*Textile Manufacturer.*

THE MANAGEMENT AND CARE OF STEAM BOILERS.

1. *Condition of Water.*—The first duty of an engineer, when he enters his boiler-room in the morning, is to ascertain how many gauges of water there are in his boilers. Never unbank or replenish the fires

until this is done. Accidents have occurred and many boilers have been entirely ruined from neglect of this precaution.

2. *Low Water* —In case of low water, immediately cover the fire with ashes, or if no ashes are at hand, use fresh coal. Don't turn on the feed under any circumstances, nor tamper with or open the safety valve. Let the steam outlets remain as they are.

3. *In Cases of Foaming.*—Close throttle, and keep closed long enough to show true level of water. If that level is sufficiently high, feeding and blowing will usually suffice to correct the evil. In cases of violent foaming, caused by dirty water or change from salt to fresh, or *vice versa*, in addition to the action above stated, check draft and cover fires with fresh coal.

4. *Leaks.*—When leaks are discovered they should be repaired as soon as possible.

5. *Blowing off.*—Blow down, under a pressure not exceeding twenty pounds, at least once in two weeks; every Saturday night would be better. In case the feed becomes muddy, blow out six or eight inches every day. Where surface blow-cocks are used, they should be often opened for a few moments at a time.

6. *Filling up the Boiler.*—After blowing down, allow the boiler to become cool before filling again. Cold water pumped into hot boilers is very injurious from sudden contraction.

7. *Exterior of Boilers.*—Care should be taken that no water comes in contact with the exterior of the boiler, either from leaky joints or from other causes.

8. *Removing Deposit and Sediment.*—In tubular boilers the handhole should be often opened, and all collections removed from over the fire. Also, when boilers are fed in front and blown off through the same pipe, the collection of mud or sediment in the rear end should be often removed.

9. *Safety Valves.*—Raise the safety valves cautiously and frequently, as they are liable to become fast in their seats, and useless for the purpose intended.

10. *Safety Valves and Pressure Gauge.*—Should the gauge at any time indicate the limit of pressure allowed, see that the safety valves are blowing off.

11. *Gauge Cocks, Glass Gauge.*—Keep gauge cocks clear and in constant use. Glass gauges should not be relied on altogether.

12. *Blisters.*—When a blister appears, there must be no delay in having it carefully examined, and trimmed or patched as the case may require.

13. *Clean Sheets.*—Particular care should be taken to keep sheets and parts of boilers exposed to the fire perfectly clean, also all tubes, flues and connections well swept. This is particularly necessary where wood or soft coal is used for fuel.

14. *General Care of Boilers and Connections.*—Under all circumstances keep the gauges, cocks, etc., clean and in good order, and things generally in and about the engine and boiler-room in a neat condition.

LET THEM ALONE.

We have recently run across some amusing experiences in which persons have been induced either by personal favor or in hopes of financial gain to displace a good engineer, who was doing his work so that not a particle of fault could be found with it, in favor of a friend or engineer recommended by some one whom they wish to please. In one case the new man was not a fixture, and his successor succeeded in one week in melting the babbitt out of a crank pin and in breaking two valve stems. In another case a first-class man was dismissed without cause. His successor did not stay three weeks, but it took three weeks to fix the machine after he had left. Don't be too willing to keep changing your engineer. If you have got a man who is devoted to your interest, who keeps your engine moving right along, is careful of your property and supplies, do not be too willing to let him go just because some great "I am" tells you he can send you a man who is better. If you find that you are not getting as many horse power from a like quantity of coal, as some of your neighbors, do not begin to look around for a new engineer the first thing, but search out from the dim recesses of your memory some of the things which you have promised the present incumbent that you would "have attended to right away," and think, if some of them were attended to, if you would not get a horse power for less money. No engineer can make steam and use it economically

with an illy designed and proportioned, or a deficient plant, and it will be well to place the fault where it belongs before making any decided move in the matter. If you have got a good engineer let him alone until you are not only sure that you have got a better one, but are also sure that the better one will stick to you when you have made a place for him.

HEATING OF JOURNALS.—A very common cause for the heating of journals having brasses and boxes composed of two halves, is that both halves alter their shape from causes attending their wear. Thus, most engineers will have noticed that, although there is no wear between the sides of a brass and the jaws of a box, yet in time the brass becomes a loose fit in the box. Now since the sides of the brass have, when fitted, no movement in the box, it is evident that this cannot have proceeded from wear between those surfaces, and it remains to find what causes this looseness. Most engineers will also have observed that though the bottom or bedding surfaces of a brass and of the box may have been carefully filed to fit each other when new, yet if in the course of time the brasses be taken out and examined, and more especially the bottom brass that receives the weight, the file marks will have become effaced on all parts where the surfaces have bedded together well, the surface having a dull bronze and condensed appearance. This is caused by the vibrations under pressure having condensed the metal. Now, this condensation of the metal moves or stretches it, and causes the sides of the brass to move away from the sides of the box, and consequently to close upon the journal, creating excessive friction that may often and very often does cause heating. It is for this reason that on such brasses the sides of the brass boxes are, by a majority of engineers, eased away at and near the joint, and it follows from this cause the same easing away is a remedy.

CLEANING BOILERS.

Crude petroleum is very effective in removing hard scale; but it should be put into the boiler when it is comparatively cool, after blowing down and cleaning out the boiler. The crude petroleum may be put in when

the boiler is being filled; it will rise to the surface of the water, and as the water rises in the process of filling, the sides of the boiler will be washed by the rising oil on the surface. We have been able to remove hard scales in this way which could not be removed by any other process. Crude petroleum is volatile, and the amount of residuum which would result from the quantity used in a boiler for such purposes would be so small as to be harmless. We would not, however, advise the indiscriminate use of crude petroleum. If the water carries vegetable matter, or is liable to be muddy, other purgers will be better. But for a hard lime scale we have found crude petroleum very effective. It will be observed that the conditions under which the oil is used in this case, are different from those where it is introduced in the exhaust from the engine. In the latter case it is introduced into the water, which is at a high temperature, and may have more or less impurity or scum on the surface; the oil readily combines with this, causing the difficulties mentioned above. While in the former case the oil is introduced cold into cold water, it washes or "varnishes" the sides of the scale-covered boiler, penetrates it, works its way between the scale and iron of the boiler, and detaches it. Those who have used petroleum to aid in removing a nut from a rusted bolt, will understand its operation. It eats out or dissolves the rust or oxide without injuring the iron. So with hard scale, it works down between the iron and the scale, eats out or lubricates the film of oxide, and detaches it.

CLEANING OUT GREASY BOILERS.

It is a very simple matter to clean out a boiler which has become greased upon the inside, if one knows how to go about it. Grease is insoluble in water. Soap is very soluble. Grease and soda combined form soap, which is easily blown out of the boiler. Therefore, the easiest and simplest way to clean out a boiler which has become fouled up with grease, is to dissolve a few pounds of soda ash or sal soda, from 10 to 25 pounds in water, put it into the boiler, fill up with water, and build up just a little fire, little more than enough to boil the water, raise say three to five pounds of steam, and let it run this way for a day or

two. If enough soda was used, the boiler will be found, if blown off now, quite free from the adherent grease ; it will only need to be washed out well to be in good condition. If there is any grease left, it is evidence that not enough soda was used or that the boiling process might be continued for a greater length of time, and the operation should be repeated.

STEAM BOILER ECONOMY.

It is estimated that there are 14,000 heat units in a pound of good bituminous coal. A heat unit is equal to 772 foot pounds, so that if all the heat units in a pound of coal could be converted into work, we should have $14,000 \times 772 — 33,000 \times 60 = 5.56$ horse power if exerted in one hour. The ordinary coal consumption is from six to twelve pounds of coal per horse power, while with boilers of the most approved design and the very best high pressure expansion engines, a duty of one-horse power for 3.1 lbs. of coal would be considered a remarkably good showing. Now, if all the heat units in 3½ lbs. of coal could be converted into work without loss, we should get instead of one horse power, 19.46 horse power ; such a result, or anything approaching it, can never be obtained, but that there is a great room for improvement, no one will deny. There is too wide a range even between 3½ lbs. and 12 lbs. of coal per horse power, and the engineer who will sit down and be satisfied with such extravagant waste as a consumption of twelve pounds of coal per horse power, is dishonest to his employer, and untrue to himself, perhaps not intentionally, but thoughtlessly so.

The first steps in economic boiler practice, is that they should be kept scrupulously clean both inside and out ; one-sixteenth of an inch of scale deposited on the inside of a boiler will reduce the conductivity of the sheets, probably 15 per cent. Soot is a perfect non-conductor, and one-sixteenth of an inch deposited on the heating surface of the boiler will reduce its conductivity fully 15 per cent. more. Steam at eighty pounds pressure will escape into the atmosphere at a velocity of nearly 1,900 feet per second, so that it is easy to see how a small leak either in the joints of the steam pipes, or in the seams of the boiler, or around the rivets, might carry off a great many heat units, thus making another tax on the coal pile.

"The concern is rich; they can stand it." This statement is heard pretty often, and it is safe to assume that the man who makes it is an unprofitable one to have in a mill. It may be that a belt is being mended, and the speaker has made a mistake, making necessary eight or ten feet of new belt. He makes the statement to ease his conscience, but it does not pay for the piece of new belting.

A side of lace leather gets neglected, or is thrown over a steam pipe when repairs are being made. Next day steam is admitted to the circulation, the lacing is ruined, and the firm "stand it," just because a man was careless. A breakdown occurs, caused by neglect of a moment's work on a set screw with a monkey wrench. Again, the "concern can stand it," for "they are rich."

It is evident that the man who makes the statement has no money invested in manufacturing, and it is also evident that he don't realize that the "concern" is growing poorer every day he is kept in their employ. There is no profit in keeping such a man, more than there is in maintaining any other nuisance. When an employee, be he superintendent or day laborer, is heard to pass his mistakes lightly, because the "concern is rich and can stand it," it is high time a change was made. That man never made the "concern" rich, neither will he help them retain their present standing. He is a weed, and must be weeded out.—*Mfg. Gazette.*

PRACTICAL THEORY.

Show me an engineeer who does not think he knows all there is worth knowing about so simple a thing as a slide valve, and I will acknowledge that I know less of the "genus," than I had supposed. Every engineer who has passed an examination by the ordinary examiner, or board of of examiners, will readily recognize these "standard" questions:

Tell me how you would set a slide-valve to get the best results? Explain the meaning of "Lap," lead, clearance, angular advance of the eccentric, etc.?

The text-books are full of answers to such and similar questions. But now stand up and "toe the mark"—be prepared to answer instantly a question I shall put to you. Suppose you were in charge of a large

factory employing a great many men, and your eccentric should slip around on the shaft. Time is money and it is important that you should set that eccentric with as little delay as possible. It would not do to take the time necessary to remove the steam-chest cover and allow things to cool down till you get at the valve.

If you are an engineer who has a pretty good opinion of himself, when the superintendent comes around, you will answer: "It is all right; I will have her running inside of five minutes." Now, presuming that the position of the eccentric is not marked on the shaft, tell me instantly, without hesitation, how you would set that valve, and know that you were right? Come—time is money. There are one hundred and fifty or three hundred men waiting for that engine, and if you are the right man in the right place, you are prepared to answer. If not, don't look in your text-books, for you will not find it there. Every engineer knows that this valve could be set by means of the indicator; and if you are equal to the emergency, you can probably devise some substitute for the indicator. No, think a moment. The indicator records, among other things, the time of admission of steam by means of pipes tapped into the end of the cylinder; and if you are up to experiments, it will readily occur to you that you can substitute the cylinder cocks for the indicator.

Now, to work. Have some one roll the engine forward in the direction it runs, till the crank is on the "dead center." Open your cylinder cocks; then open the the throttle slightly, so as to admit a small amount of steam to the steam-chest. Roll your eccentric forward in the direction the engine runs, until steam escapes from the cylinder cock at the end where the valve should begin to open. Now screw your eccentric fast to the shaft. Roll your crank to the next centre, and ascertain if steam escapes at the same point, at the opposite end of the cylinder. If so, ring your bell and go ahead. You are all right and can run until an opportunity occurs to open your steam-chest and examine your valve.

DO YOU DO THESE THINGS?

A writer in a contemporary asks and answers the following pertinent questions:

Do you take a squirt-can in one hand and project a stream of oil as far as you can throw it, in order to save going to the oil hole itself?

If you do, don't do it any more; willful waste is downright robbery.

Do you use an oil can at all for oiling, except on emergency, or for the moment?

If you do, don't do it any more; for much better lubrications can be had by automatic apparatus.

Do you keep an old tin coffee pot full of suet on the steam-chest, and every time you have nothing else to do, pour a dipperful into the steam-chest?

If you do, stop it, and get a sight feed cup, which will save you the labor of slushing the cylinder and save the cylinder and valve seats, the piston and follower, and all other places touched by the grease.

Do you feed upon the boiler until the water is out of sight in the glass, then shut off the feed, put in a big fire and sit down in a dark corner with a four-horse brier pipe and smoke until you happen to think that maybe the water is low?

If you do these things you should notify the coroner that some day his services will be needed, but it is better to cease the practice mentioned before the coroner comes.

Do you stop leaks about the boiler as fast as they occur, or do you wait until the places sound like a snake's den before you stir?

If you do, you waste heat, which is the same word as money, only differently spelled. Every jet of hot water leaking from a steam boiler is just so much money thrown away, and if it was your money you would be bankrupt in a short time, in some boiler rooms.

Do you take a screw wrench and yank away at a bolt or nut under steam pressure?

If you do, there will come a time, sooner or later, when you will do so once too often, and either kill yourself or someone else. Bolts and nuts are liable to strip or break if tampered with under pressure, and they never tell anyone beforehand when they are going to do it.

Do you attempt to stop pounding in the engine by laying for the crank pin as it comes round and trying to hit the key once in a while?

If you do, ask the strap and neck of the connecting rod how he likes it, when you don't hit the key and do hit the oil-cup.

Do you pack the piston by taking it out of the cylinder, laying it on the floor, setting out the rings, and then when the piston will not go into the cylinder, try to batter it in with a four-foot stick of cordwood?

If you do, you should reform, and pack the piston in the cylinder where it belongs, being sure to get it central by measuring from the lathe center in the end of the piston rod.

Do you put a new turn of packing on top of the old, hard-burned stuff when the piston rod leaks steam?

If you do, you will have a scored piston rod and broken gland bolts some day. Packing under heat and pressure gets so hard that it cuts like a file when left in the stuffing box, and as one begins to leak, all the old stuff should be pulled out and new put in its place.

WORDS OF CHEER.

Office of J. HODGE, Doors, Sash and Blinds, etc., Manchester, N. H.

St. Louis, May 26, 1892.

Shultz Belting Company, Boston, Mass.

Gentlemen:—You know I have used Shultz belt when it was first introduced here. Wherever my old belts wear out, Shultz belt takes its place. *I cannot afford to use common belting at any price.* Shultz belts does enough, more and better work, to pay for themselves in a short time.

Yours truly,

(Signed) J. HODGE.

Office of MISSOURI FURNACE COMPANY.

St. Louis, June 13, 1882.

Shultz Belting Company, St. Louis, Mo.

Dear Sirs:—We have used your Valves for blowing Blast Furnaces. They are the best we have ever used; stand the heat well and outwear any others; have some in constant use three years.

GEO. F. DAVIS, Eng'r.

ST. LOUIS & SUBURBAN RAILWAY CO.

St. Louis, Mo., May 14, 1892.

Shultz Belting Company, St. Louis, Mo.

Gentlemen:—In answer to your inquiry, will say we are running two of your 72-inch main driving belts, each 150 feet long, two 34-inch and ten 16-inch generator belts, all heavy double, and we are happy to state that we have never been stopped, or delayed one moment on account of the belts. They are giving us entire satisfaction, running noiseless, straight smooth, and driving full power. The 72-inch belts developing from 200 to 300 horse-power more than your guarantee; in fact, we believe that we have as good, if not *the best belted power station in this country.*

Yours truly,

CHAS. H. TURNER,
President.

THE INVENTION OF THE AGE.

ST. LOUIS, July 22, 1890.

SHULTZ BELTING COMPANY.

Gentlemen:—In reply to your inquiry as to the working of your Patent Pulley Covering, I take pleasure in stating that they do all you claim for them. We have very little, if any, slipping of belts and can run with a slack belt; this means no hot journals. We have them on both of our Edison dynamos.

Yours truly,

W. A. RUTLEDGE, Eng'r.,
Mermod & Jaccard Building.

GINNA & CO.

Manufacturers of Plain and Decorated Tin Boxes.

NEW YORK, April 16, 1892.

A. B. LAURENCE, ESQ., Manager, 225 Pearl St.

Dear Sir:—Your valued favor of 5th inst. duly to hand and owing to absence of writer, to whom it was referred, reply has been delayed.

We are pleased to bear favorable testimony to the Shultz Rawhide belting and are *replacing all our belts with it as they wear out.* We find it much stronger than ordinary leather belting and does not stretch as belting heretofore used.

Very truly,

GINNA & CO.

CARPENTER & DYETT,

Manufacturers of Folding Cots and Chairs and Woven Wire Mattress Frames.

ROME, N. Y., April 8, 1892.

A. B. LAURENCE, Manager.

Dear Sir:—We have used the Shultz belts for the last five years, with unvarying satisfaction and whenever we want a reliable belt for a trying or hard running machine, we will have no other. We have two machines where the belts run over from four to ten pulleys and we have found *by actual test that your belt will wear as long as two of any other make* that we have yet tried.

Yours truly,

CARPENTER & DYETT.

THE NYE & WAIT CARPET CO.

AUBURN, N. Y., April 5th, 1892.

SHULTZ BELTING COMPANY.

Gentlemen:—Our experience with the Shultz rawhide belting has been very satisfactory, the stretch is very soon taken out of it and on account of its great pliability and consequent slackness in running, it will transmit more power than any belt we have ever used. And at the same time, its durability is far greater. *Its first cost should not be considered.*

Very truly yours,
THE NYE & WAIT CARPET CO.
G. H. NYE, President.

STANDARD FURNITURE COMPANY.

HERKIMER, N. Y., April 12, 1892.

MR. A. B. LAURENCE, Manager, 225 Pearl St., N. Y.

Dear Sir:—Replying to your letter of 9th instant, the Shultz rawhide belting, which we purchased of you, has been running for nearly two years with the most satisfactory results; and *notwithstanding the high price* at which it is sold, we believe it to be *much cheaper, quality considered,* than any other belting on the market.

Yours truly,
STANDARD FURNITURE COMPANY.

NATIONAL CASKET CO.

ROCHESTER, N. Y., April 11, 1892.

MR. A. B. LAURENCE, NEW YORK, N. Y.

Dear Sir:—Your letter of April 5th at hand. Would say we have sent to you our orders for belting, when we know that no ordinary belt will do the work, and have not been disappointed in the expected result, which is that your belts will not stretch as much as ordinary belting, give *better service, less repairs,* run easier, and we have not worn one out, and we believe that there is *nothing better* in the market than your belting and recommend it in all places *where hard service is required.*

Respectfully yours,
L. B. LOZIER.

THE THOMPSON-HOUSTON ELECTRIC CO.

Electric Lighting, Railway and Power Systems.

NEW YORK, June 7, 1892.

JAMES GARNETT, ESQ., Manager, SHULTZ BELTING COMPANY,
129 North Third Street, PHILADELPHIA, PA.

Dear Sir:—This is one of the few occasions when it seems to me proper to endorse any article entering into work of producing light and power, but my desire for the proper development of the electric trade is so great that I cheerfully testify to the fact that I buy only Shultz belts, and this after *nine to ten years experience with them in widths from 2½ to 58 inches.*

I trust that your success will enable you to sell for less money than in the past.

Yours truly,

JOHN J. MOORE.

GEO. S. HUTCHINGS, Church Organ Builder.

BOSTON, MASS., Jan. 16, 1890.

THE SHULTZ BELTING COMPANY, BOSTON, MASS.

Gentlemen:—I am so much pleased with that trial belt that I want more. Although your belting is considerably higher than that of other makers, I think it is well worth the difference.

Please send me by bearer, 51 ft. 6 inches of 6-inch belt and 14 ft. 4 inches of 5½-inch belt, and please send cement enough to put the 5½-inch belt together. Charge to my account.

Yours very truly,

GEO. S. HUTCHINGS.

EPPLER WELT MACHINE CO.

BOSTON, May 11, 1892.

GEO. J. KELLEY, Manager SHULTZ BELTING CO., BOSTON.

Dear Sir:—We wish to contribute a word about the excellence of your belts. All the belts in our factory are Shultz belts, and we have now been running a year with absolute satisfaction in every particular, especially the (link) belt for the motor with which we are very much pleased, and we take pleasure in recommending them to all users.

Respectfully,

EPPLER WELT MACHINE CO.,
ANDREW EPPLER, Supt.

MASSACHUSETTS COTTON MILLS.

LOWELL, February 18, 1889.

MR. W. P. MULLIN, Vice-Pres. SHULTZ BELTING COMPANY, BOSTON.

Dear Sir:—I take pleasure in saying that after several years' experience with the Shultz Belt, I am thoroughly satisfied of its durability and efficiency; and should now hardly know how to get along without it. I have used it for the most difficult service to which belting can be subjected in a cotton mill, and in widths from one to forty inches. Yours truly,

W. S. SOUTHWORTH, Superintendent.

Substitution of Shultz belts for oak tanned leather.

(From same mills four years later.)

INCORPORATED 1889. CAPITAL, $1,800,000

MASSACHUSETTS COTTON MILLS.

LOWELL, MASS., May 9, 1892.

SHULTZ BELTING COMPANY, 164 Sumner St., BOSTON, MASS.

Gentlemen:—In answer to your inquiry as to the working of your belting, I will say that we have in use of your double belting, twenty-one or more widths from 1½-inch up to 40-inch, inclusive, and to show that we have a fair number of wider widths, will say that the widths commencing at 10 inches are as follows: 10-inch, 11-inch, 12-inch, 16-inch, 17-inch, 18-inch, 20-inch, 21-inch, 30-inch, 32-inch, 36-inch and 40-inch. The 30-inch belt is 166 feet long and 36-inch is 209 feet long. The 32-inch has run for a year where we started up with the best 30-inch oak double which we could procure and which we tore entirely in two twice before substituting your 32-inch. A number of the others were put on in place of oak belts which could not do the work successfully.

Yours truly,

(Signed) H. J. WOODMAN, Superintendent.

A Paying Investment.

STIRLING MILLS.

LOWELL, MASS., May 9, 1892.

MR. GEORGE J. KELLEY, Manager,
SHULTZ BELTING COMPANY, BOSTON, MASS.

Dear Sir:—We are now using and have used for ten years the Shultz Company's belts. We should not do so if we did not find it paid us. Yours respectfully,

ALBION F. SWANTON, Superintendent.

Exceptional Testimonial.

VICTORIA MILLS.

NEWBURYPORT, MASS., May 12, 1892.

GEO. J. KELLEY, ESQ., Manager,
SHULTZ BELTING COMPANY, BOSTON, MASS.

Dear Sir:—We are not in the habit of writing testimonials, but your rawhide belting has given such excellent satisfaction since we commenced using it, twelve years ago, that we feel it our duty to so inform you.

Very truly yours,
OTIS L. FARLEY, Agent.

ALFRED HARVEY.

Silk Throwster, Tram and Organize a Specialty.

SCRANTON, PA., May 14, 1892

JAMES GARNETT, ESQ.

Dear Sir:—Please send light double belt for the following: Distance between shafts from center to center, 17 feet 9 inches; diameter pulleys, 38 inches, and 10 inches. Belt to be 10 inches wide.

I will add right here that your belt is the most satisfactory of any belt I have any knowledge of, and prior to using the Shultz Belt I bought the best oak tanned belt I could get. I could not be induced to go back to the old belts. Your belts keep soft, drive stronger, and no necessity for oiling. They are the best belt on the market.

Yours respectfully,
A. HARVEY.

HARRISBURG ELECTRIC CO.

HARRISBURG, PA., October 3, 1885.

JAMES GARNETT, ESQ , Agent, SHULTZ BELTING COMPANY,
129 North Third Street, PHILADELPHIA, PA.

Dear Sir:—Herewith enclosed please find check in payment for ten "Shultz Patent Fulled Leather Belts" furnished us in April last upon six months' trial, to be paid for if entirely satisfactory to us, which I am pleased to say is the case, as we have no fault whatever to find with the belts; and while the price of them is very much higher than other first-class belts which we could have purchased, we believe these to be the *cheapest in the end*, as we have

had no evidence whatever of any slipping on the pulleys, all the power of the engines being transmitted to our dynamos by the use of these belts, which, in incandescent lighting, is a very important matter, and against which a few hundred dollars invested in belts of a quality suitable for the purpose is no consideration. Thanking you for the prompt and satisfactory manner in which our order was filled, and wishing for you the most abundant success, which your belts certainly deserve, I remain, with kind regards,

Yours very truly,

JOHN I. BEGGS,
General Manager.

THE HARRISBURG ELECTRIC LIGHT CO.

Edison Incandescent System.

HARRISBURG, PA., May 12, 1892.

JAMES GARNETT, ESQ., Manager, SHULTZ BELTING COMPANY,
129 North Third Street, PHILADELPHIA, PA.

Dear Sir:—In reply to your inquiry of May 11th, it gives us pleasure to add our testimony to the many words of commendation of the Shultz Belting. We have been well pleased with its durability and efficiency, and have appreciated its merits to such an extent that we have used no other in our central station since the original installation of your belting seven years ago. We are,

Very truly yours,
HARRISBURG ELECTRIC COMPANY,
By CHARLES H. KINTEN,
General Manager.

One 40-inch, two 36-inch, two 30-inch; over 30 of smaller sizes in use.

Office of CAMBRIA IRON WORKS.

JOHNSTOWN, PA., March 3, 1883.

J. A. J. SHULTZ, ESQ., Pres't, ST. LOUIS, MO.

Dear Sir:—In reply to your favor of Jan. 26th, the Valves we received from your Company, in September last, were placed on the most severe parts of the engine, and are still in use. Those made of ordinary leather often last but a few days. We find your valves to be the best we have ever used.

Yours respectfully,

D. J. MORRELL,
General Manager.

HARVEY & SULLIVAN,
Operators of Saw Mills for the Buffalo Hardware Co.

AUSTIN (Potter County), PA., May 13, 1892.

JAMES GARNETT, Manager,
SHULTZ BELTING COMPANY, PHILADELPHIA, PA.

Dear Sir:—Your agent was here a few days ago, and we ordered a 12-inch (light double leather) Shultz belt. We have used these belts for six years. We have some of the belts we bought of you six years ago running yet—in fact, all the belts that have not met with accidents are running yet.

Our mills run night and day, all the time, some give the belts a very severe test. They give us entire satisfaction. You know as we buy no others. From our 44-inch belt to the smallest, they are all of the Shultz make.

We are cutting 400,000 feet of lumber every 24 hours.

Yours respectfully,
HARVEY & SULLIVAN.

WALKER & KEPLER,
Electrical Contractors, Dealers in
Supplies, Electroliers, Specialties, Edison Electric Light System,
531 Chestnut St.

PHILADELPHIA, PA., May 12, 1892.

SHULTZ BELTING CO., No. 129 N. Third St., PHILA.

Gentlemen:—Replying to yours of the 11th, we take pleasure in saying we have been using your belts for the last eight years, and during this time we have never had one belt that has not given entire satisfaction. Yours respectfully,
WALKER & KEPLER.

K.—Over 150 Belts of different sizes.

EDISON PHONOGRAPH WORKS

ORANGE, N. J., April 7, 1892.

A. B. LAURENCE, ESQ., Manager, SHULTZ BELTING COMPANY.

Dear Sir:—Replying to your letter of the 5th, in regard to the 10-inch belt which you furnished for our No. 12 Dynamo, and the two 3½-inch belts for the Sturtevant Blower, would say that they have been running for nine months and have *never given us one moment's trouble.* Yours very truly,
EDISON PHONOGRAPH WORKS,
GEORGE F. BALLOU,
Superintendent.

Office of PEIFFER & CO., Manufacturers of Hat Bodies.

NEWARK, N. J., April 19, 1892.

Mr. A. B. LAURENCE, Manager, SHULTZ BELTING COMPANY.

Dear Sir:—We take great pleasure in adding ours to your list of testimonials for the efficiency of your rawhide leather belting.

During the past two years we have had several hundred feet in use—both double and single—which has given *perfect* satisfaction. We find it to be stronger, to run with less stretch, more pliable and the adhesiveness to pulleys *much* greater than any other belting which we have had occasion to use during our twelve years' experience in "Hat Forming"—a business very trying on belts.

Yours truly, A. W. WHITEHEAD.

Office of LA CROSSE BRUSH ELECTRIC LIGHT & POWER CO ,

LACROSSE, WIS., April 26th, 1894.

SHULTZ BELTING CO., ST. LOUIS, MO.

Gentlemen:—Agreeably to your desire for an expression of our experience with the twenty (20) inch, three-ply Rawhide Leather Belt, furnished us in 1883, say that it has been in constant use ever since, and has given us perfect satisfaction. Once, in 1889, when a change in the position of our countershafting made it necessary, has the belt been cut, and it is yet as tight as a fiddle string, and as sound as ever it was. It is the only one of the kind we have in our electric plant, and though not the largest, it is much the best.

Yours truly,

LACROSSE BRUSH ELECTRIC LT. & P. CO.

By GEO. MACMILLAN, Sec'y-Treas. & Mgr.

Office of LA CROSSE BRUSH ELECTRIC LIGHT & POWER CO.,

LACROSSE, WIS., March 17, 1896.

SHULTZ BELTING CO., ST. LOUIS, MO.

Gentlemen:—Replying to your inquiry as to what the 20-inch Rawhide Leather Belt furnished by your company in 1883 is still doing, we can say that it has been in constant service since Mr. MacMillan wrote you on the subject in April, 1894; has done perfectly satisfactory work during that time, and shows no signs of weakening. It is used as a driving belt without tightener, has never required to be taken up, and is as tight on the pulley as when placed there. Our present superintendent has been with us eleven years and claims that the belt is as sound as it was when he first commenced with our company.

Yours very truly,

LACROSSE BRUSH ELECTRIC LT. & P. CO.

By C. H. GREENWOOD, Sec'y and Treas.

Office of TERRE HAUTE CAR & MFG. CO.

TERRE HAUTE, IND., June 29, 1892.

SHULTZ BELTING COMPANY, ST. LOUIS, MO.

Dear Sirs:—We have been using various sizes of your belting, both single and double, for several years, and have adopted the use of it exclusively for all our heavy work, as it has been giving us better satisfaction than any belt we have been able to get.

As long as you continue to keep up the quality of this belt you may expect to get our orders.

Yours truly,

ROBERT S. COX,
General Superintendent.

Office of ALLAIRE, WOODWARD & CO.,
Manufacturing Chemists.

PEORIA, ILL., January 7, 1886.

SHULTZ BELTING COMPANY, ST. LOUIS, MO.

Gentlemen:—In your last you ask if we have not gone back on your belting. In answer, we will say we have not. The fact is, it seems to never wear out. It is just five years since we commenced using your belt, and during that time we have replaced all the old belts in use before, but have had no occasion to replace any of yours.

Yours very truly,

ALLAIRE, WOODWARD & CO.

WOULDN'T DO WITHOUT THEM FOR FOUR TIMES THEIR COST.

OFFICE OF MUSCATINE GAS, ELECTRIC LIGHT AND POWER COMPANY.
MUSCATINE, IA., July 15, 1890.

J. A. J. SHULTZ, ST. LOUIS.

Dear Sir:—In reply to yours of the 9th inst., where you say you think the pulleys are too small to cover your way and make a good job of them, you ought to come up this way and see them; you will then think otherwise. You could not have them back for four times what they cost us. I did the job neatly—beautifully, I might say—and the belt runs lovely.

Yours truly,

JAMES HANNAN,
Superintendent.

Office of THE BRANNING MANUFACTURING CO.

Manufacturers of Carolina Pine Lumber, Kiln-dried Dressed and Undressed.

EDENTON, N. C., May 13, 1892.

JAMES GARNETT, ESQ., Manager,
SHULTZ BELTING CO., PHILADELPHIA, PA.

Dear Sir:—In reply to yours of the 11th, would say *I have been using your belts for 10 years* or more, and can cheerfully say they have in all cases given entire satisfaction, and I think they are the *best belts in the market.*

Yours truly,

J. W. BRANNING,
President.

GRAFTON ELECTRIC LIGHT CO.

GRAFTON, N. D., April 27, 1892.

SHULTZ BELTING CO., ST. LOUIS, MO.

Gentlemen:—I herewith enclose you our check No. 3,437, for $133.56 in payment of your (link) belt sent us last Feb'y. It is a fine belt, and to say that we are more than pleased with it does not express our feeling towards it, as we have *saved more than the cost of it in fuel* since it was put in, besides it transmits 7 h. p. more than the belt we used before.

Yours truly,

(Signed) T. H. THARALSON,
Secy. and Treas.

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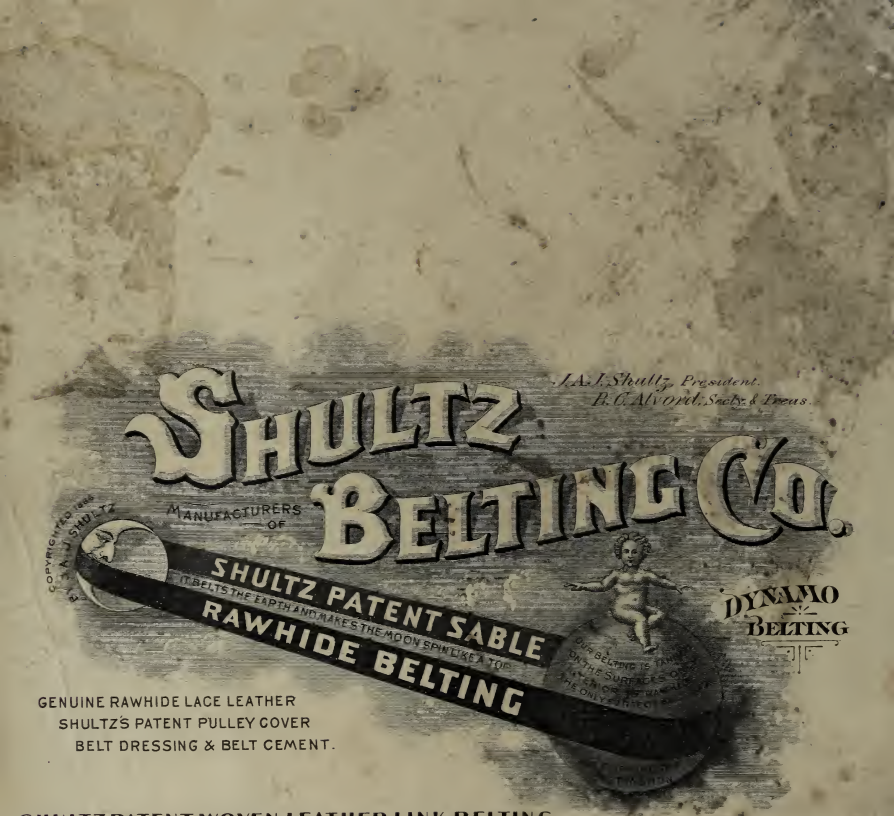
J. A. I. Shultz, President.
B. C. Alvord, Secty. & Treas.
SHULTZ BELTING Co.
MANUFACTURERS OF
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SHULTZ PATENT SABLE
IT BELTS THE EARTH AND MAKES THE MOON SPIN LIKE A TOP
RAWHIDE BELTING
DYNAMO BELTING
GENUINE RAWHIDE LACE LEATHER
SHULTZ'S PATENT PULLEY COVER
BELT DRESSING & BELT CEMENT.

SHULTZ PATENT WOVEN LEATHER LINK BELTING

St. Louis, Mo. U. S. A.

GEO. J. KELLEY, MANAGER,

164 Summer Street,

BOSTON, MASS.